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## Detrick's Improved Single Post Iron Planer.

In our issue of Oct. 14, 1882, we illustrated a planer of this kind, built by Detrick & Harvey, Baltimore, Md. Since then it has been re-designed and materially changed in construction, the present engraving representing it as now made. This planer has a post on one side only, and is more especially intended for use in works where long and wide work is handled, as in bridge and locomotive shops, architectural works, &c., saving the expense of a large two-post planer.

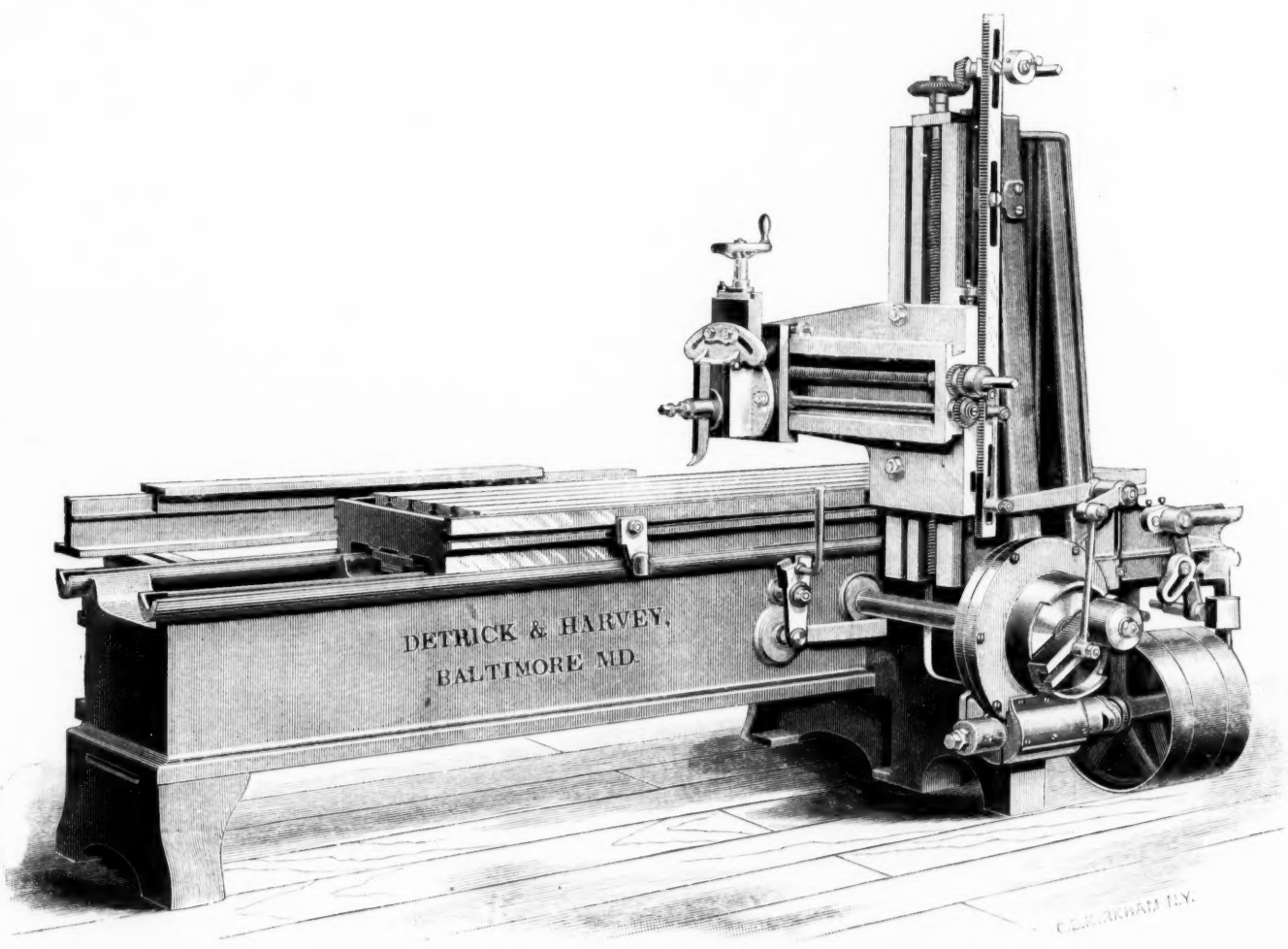
This single post is L shaped, placed with the long side parallel, and the short side at right angles with the bed, to which it is firmly secured, and from which it extends to the floor, making one of the feet of the planer. It is strongly ribbed and braced, so as to resist deflection when the tool is cutting.

The cross-beam is heavy with a wide bearing on the post, and to further strengthen it against a tendency to spring a triangular brace on the back side extends to the post against which it takes a bearing, moving up and down with the cross-beam.

The face of the cross-beam and of the post are made identical, so that the saddle can be used on either. Thus when the work is of such dimensions that it will not pass the beam the latter can be removed and the saddle placed on the post, the tool-box having a vertical movement from the top to bottom of post, permitting the planing down of a deep surface.

On the side opposite the post are two T-slots running the entire length of the bed, to which are bolted brackets. Upon these brackets there is a rail or track, which is adjustable towards and away from the bed. A table corresponding in height to the planer platen, slides upon this track. This table can be used for holding up long or wide pieces of work, or will serve as a pivotal joint for planing segments of circles. The sliding table is moved simultaneously with the platen by bolting the work to it, or it may be moved by connecting rods.

In this machine the first driver is the Albro-Hindley screw, the rest of the gearing being cut spur. The Matthews feed is used, operated directly from the driving shaft. The tool has horizontal, vertical, and angular automatic feed, capable of variation up to one-half inch horizontally and one-quarter inch vertically. The belt velocity is high, and the belt shifter is entirely independent of feed gear.




IMPROVED SINGLE POST PLANER.

## Personal Recollections.

BY S. W. GOODYEAR.

### MACHINERY FOR MAKING WOOD SCREWS.

Leaving the sewing machine business to be continued under the supervision of another man early in the sixties, I took charge of building machinery for the manufacture of wood screws, on the same premises and for the same party who had carried on and still continued the manufacture of the sewing machine.

### MACHINE FOR HEADING THE BLANKS.

Believing that there may be some of your readers who will be interested in a brief description of some of the difficulties which I encountered, and as heading the blanks comes first in the manufacture of screws, I will describe the header, which was built and adopted, as a rotary solid die machine, the first one built being at that time the first and only heading or rivet machine I had ever seen. Eight dies constituted a set, the dies being round, and fitted to eight holes through what was called a die plate, these holes being equidistant from each other and from the center of the plate. To place these holes correctly through this plate, to attach the plate to the spindle on which it worked in such a manner that it could be removed and replaced many times, always in exactly the same position, to attach to the spindle a ratchet plate and a stop plate so accurately that, as the plunger dropped into each of the notches in the stop plate successively, each of the eight dies should come to exactly the same position relative to the cutting-off die, the heading punches, and the punching-out spindle, and not only so that one die plate should "come right," but so that a great number of similar die plates of different thicknesses, for different lengths of blanks, should "come" equally well on the same spindle, seemed to me to require something more than what is known as close work.

A method was required which would, with proper care, produce the same results over and over. I soon found that what had been considered a reliable index plate, was very far from perfect. The holes were reamed over with much care by Messrs. Pratt & Whitney, of Hartford, Conn., after which the ratchet and stop plates could be cut with sufficient accuracy. But to devise some simple and certain method of holding the die plates on the spindle, by which they should be interchangeable, gave me subject matter for some study, resulting as follows: The extreme thickness of all the die plates, including the length of hub, was made alike, and such as would leave about $\frac{3}{4}''$ length of hub projecting on the thickest plate to be used. That part of the spindle which received the plates was turned down sufficiently to furnish a good strong shoulder, against which the plate was held by a nut at the end of the spindle. To insure the correct adjustment of the plate on the spindle, a stud was fitted to a nicely-reamed hole in the table of a planer, the part of the stud projecting above the surface of the table accurately fitting the hole in the die plate. With a try-square placed against the front of this stud for one edge of the table, and against the back of the stud for the other edge, lines were plainly scribed at such a distance from, and at right angle with, the edges of the table as would intersect the line represented by the periphery of a die plate when placed upon the vertical stud.

Now, clamping the die plate down firmly, with the stud acting as an axis upon which it might be revolved, a slot was planed, say $1\frac{1}{2}''$ wide and deep, through the end of the hub. This slot was to be tapering, and absolutely central (practically). To secure this, a chip was run down one side of the slot of such depth as would permit planing the other side to the required taper and leave the slot central, and then making a mark on the periphery of the plate corresponding with one of the lines on the table, leaving the tool set in the same position, the clamping device was loosened and the plate turned on its axis just as much less, or more, than half a revolution as would produce the required taper; this, by the aid of the lines on the planer table, and the line on the plate easily arrived at. Now, clamping the plate down again, the tool was fed down the second side of the slot from precisely the same position as when the first side was planed, after which, with a sharp finishing tool, a light cut was taken from this side of the slot, the tool left in the same position, a mark made on the planer table to indicate exactly the position of the mark on the periphery of the plate, the plate returned and clamped in its first position, and the tool fed down the side of the slot now presented, and a perfectly central tapering slot was had, besides having provided fixtures and a method whereby any number more of the plates could be slotted across the hub precisely like the first one.

The plate was now slipped to its place on the spindle, the position of the slot marked, and a hole drilled through the spindle, which was filed out to match the taper slot in the end of the hub. To this taper mortise, through the hub and spindle, a key was nicely fitted, by driving which in, and screwing up the nut, the plate was securely held, and

could be removed and replaced without danger of changing its position.

I have, perhaps been tiresome in describing the method employed for getting this slot central, but as the same principle may be used so often, and it is just possible that some of the apprentices have not learned the wrinkle yet, I don't like to drop it without urging anybody who has been in the habit of working to fine lines and close measurements, using a magnifying glass at that, in planing a groove or slot in the exact center of a piece, to try changing ends with the work with the tool standing in the same position for both sides of the groove, wherever practicable. It is simple and easy and sure. I have known good workmen, however, who would not try it. I knew a first-class man, whose tool making for years consisted largely of a kind of die making, in which a hole was to be drilled and reamed between two blocks of steel, as nearly central as possible, to insure which the two blocks of steel—alike in width and thickness—were scored together, in planer or shaper, with a pointed tool of 45 degree angles, whereby, on putting the faces of the blocks together, a square hole would result, the size of which depended upon the depth of cut of the tool. This hole was easily changed to a round one, and acted as a guide for drill or reamer. As a guide by which to do this scoring, the man of whom I speak would put a pair of blocks in the chuck in which they were to be drilled, and with great care turn with a hand tool a conical recess by which to do the planing; then, with much cutting and trying and the use of a glass, the scoring was done entire without changing the blocks till done.

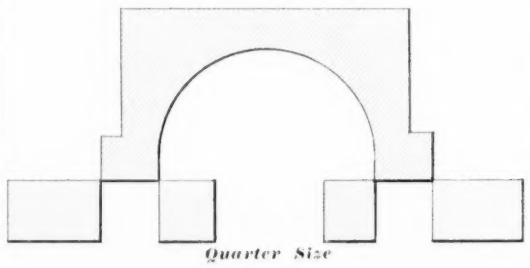
OLD METHODS OF DOING CLOSE WORK.

We all know about this sort of "close work," and the squints and scowls and uncertainties as to whether the tool is set just right, or should be moved just a little, and which way, if at all. Still this man persisted for ten years, in spite of precept and example, in putting that conical recess in each pair of dies which he scored. That if he had just scored a pair of dies centrally, he could, by leaving the tool in the same position, score another pair just the same, he could not be convinced. *That mark to work by must be there.* *He* wanted to know that *his* work was *right*, even if it did take a little longer. That an apprentice, with a shop experience of a less number of months than our first-class workman had of years, could put a pair of die blanks in the planer or shaper vise, or wedge or screw them against a fixed bracket or angle iron, and without stopping to even measure, set the tool at a guess and run a light chip through, change ends with the die blanks, and with tool in same position note which way it was "out," and how much, and shift it accordingly, he could not understand. That this same apprentice could take another light cut, change the blanks again, and without raising the tool, see if it would just run through without cutting—which was the test for absolutely central position of the tool—but if it did touch a little by letting it cut through, the groove would be central, in this way getting the first pair scored right and the tool set right for any number of additional pairs, while he, "the exact man," was fussing away at the lathe to get a mark to work by—all this made no impression upon him.

But some inquisitive mechanic will want to know how the holes for the dies were located in the die-plate. The spindle, with its ratchet and stop-plates, keys solidly in position, was slipped into its place through the objective end of the bed-piece of the heading machine. The die-plate was slipped to its place on the inner end of the spindle, the taper locating and holding key was driven to its place and the nut screwed home against the end of the hub; the plunger was dropped into one of the tapering notches in the stop-plate, the punching-out spindle was made to do duty as a drill spindle, and the eight holes through the die-plate were each drilled in place as they were to work. With the plate accurately drilled, and a certainty that at each stopping point in its intermittent revolution on of the dies would range exactly with the punching-out spindle, there were still two other important points which each die in turn must match. One of these positions was exactly in range of the solid cut-off die, when in its upward motion after cutting off a piece of wire it stopped exactly in range of the punching-in spindle which carried a punch through the cutting off die, and into the heading die, pushing the piece of wire in front of it. The other was exactly in range of the heading punch which struck the first blow, and was made concave to insure concentricity of the head, or to counteract the certain tendency to bend in some direction, which comes of upsetting. All these necessary conditions were complied with, by making parts which *were* help to locate others which *were to be*, and with the taper slot through the end of the hub in each new die-plate made, as the initial point, it was easy from the first plate made to arrange a method of drilling the holes for dies in any number of plates, so that they must "come right." It is probable that to mechanics who know all about rivet machines a condensed description of how the machine worked will be uninteresting, but for others I will venture a description.

OPERATION OF THE MACHINE.

On a reel was placed a coil of wire, the end of which passed on its way to the feeding device between a series of grooved rolls, so arranged as to constitute what is called a roll straightener. The feeding device consisted of a pair of gripping jaws attached to



*Quarter Size*

FIG. 1.

a slide, the motion of which was adjustable by means of a compensating lever, which, with its connection rods—extensible by means of right and left hand screws and extension nuts—made it a simple matter to get from a cam, the throw of which was fixed, any motion required from a fraction of an inch up to several inches, at the same time locating the feeding jaws in the most desirable position for any length of feed required. The end of the wire being carried forward through the cut-off dies just the right distance to give the length required, the slide carrying the inner cut-off die was moved by means of a cam and lever, until the die containing the piece of wire cut off by the motion was brought in exact range with one of the heading dies. Next the punching-in punch came forward and pushed the piece of wire out of the cut-off die, and into the heading die, dropped back to its place, the cut-off die dropped back in line with its mate again, and the feeding dies, which had dropped back and got another hold, brought in another piece of wire to be cut off. In the meantime, the die-plate had made one-eighth of a revolution, bringing the projecting end of the wire to be headed in line with the first heading punch, which, coming forward through the agency of an eccentric, combined with a toggle joint, upset the end of the wire, forming a pear-shaped bulb, and fell back again to its place. These operations were continued in rapid succession until the pear-shaped bulb had been forced home by the second heading punch, the blank to which the completed head belonged had reached a point in line with the punching-out punch, and been punched out of the heading die, smoking hot, and then the machine was fairly at work. Each revolution was then closing and opening, and carrying forward and back the feeding jaw. Was cutting off and carrying to place a piece of wire and taking the sliding cut-off die back for another piece. Was pushing a piece of wire into one heading die, and a headed blank out of another, and returning the punching-in and punching-out spindles to their position of rest. Was withdrawing the plunger from a niche in the stop-plate and advancing the die-plate an eighth of a revolution, and taking the pawl back ready for the next motion. Was carrying forward the heading slide with its first and second heading punches to do their work, and for each second of time a screw-blank was made. Machines are in use which make five in a second. How would this compare with heading rivets by hand? How were they made, or where were they procured, prior to 1830? For a prominent manufacturing concern, whose statement is backed up with a beautiful miniature copy of Henry Sargent's "Landing of the Pilgrims," have on their business card "First rivet works in America established in 1830." And now half a century later, with rivets and screw-blanks by carloads, made daily by automatic machines, this reminder of the "Old Plymouth Works" should help us to realize what strides have been made in the mechanical world.

## Locomotive Engine Running—Valve Motion.

BY ANGUS SINCLAIR.

THE LOCOMOTIVE SLIDE VALVE.

The nature of the service required of locomotive engines, especially those employed on fast train service, makes it necessary that the steam distribution gear shall be free from complication; and for convenience in working the engine, it is essential that means should be provided for reversing the motion promptly without endangering the working parts. The valve gear should also be capable of regulating the admission and exhaust of steam, so that the engine shall be able to maintain a high rate of speed, or to exert a great tractive force. These features are admirably combined in the valve gear of the ordinary locomotive. Designers of this form of engine have given great consideration to the merit of simplicity. Numerous attempts have been made to displace the common D slide valve; but every move in that direction has ended in failure.

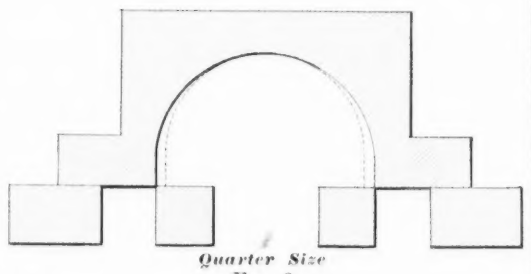


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FIG. 2.

INVENTION AND APPLICATION OF THE SLIDE VALVE.

The slide valve, in a crude form, was invented by Murray, of Leeds, England, towards the end of last century, and it was subsequently improved by Watt to the D form. It received but little application in England till the locomotive era. Oliver Evans, of Philadelphia, appears to have perceived the advantages possessed by the slide valve, for he used it on engines he designed years before locomotives came into service. The D slide valve was better adapted for high speed engines than anything tried during our early engineering days, but it was on locomotives where it first properly demonstrated its real value. The period of necessity brought the slide valve into prominence, and the galaxy of mechanical genius that heralded the locomotive into successful operation recognized its most valuable features, and it soon obtained exclusive possession of that form of engine. Through good and evil report, and against many attempts to displace it, the slide valve has retained a monopoly of high speed-reversible engines.

DESCRIPTION OF THE SLIDE VALVE.

The slide valve in common use is practically an oblong cast iron box which rests and moves on the valve seat. In the valve seat, separated by partitions called bridges, are three ports, those at the ends being the openings of the passages for conveying steam to and from the cylinders, while the middle port is in communication with the blast pipe which conveys the exhausted steam to the atmosphere. On the under side of the valve is a semi-circular cavity which spans the exhaust port and the bridges when the valve stands in its central position. When the steam within the cylinder has performed its duty of pushing the piston towards the end of the stroke, the valve cavity moves over the steam port and allows the steam to pass into the exhaust port, thence into the exhaust pipe. The cavity under the valve thus acts as a door for the escape of the exhaust steam. This is a very convenient and simple method of educting the steam, and the process helps to balance the valve, since the rush of escaping steam striking the under part of the valve tends to counteract the pressure that the steam in the steam chest continually exerts on the top of the valve.

PRIMITIVE SLIDE VALVE.

In its primitive form the slide valve was made merely long enough to cover the steam ports when placed in the central position as shown in Fig. 1. With a valve of this form the slightest movement had the effect of opening one end so that steam would be admitted to the cylinder, while the other end opened the exhaust. By such an arrangement steam was necessarily admitted to the cylinder during the whole length of the stroke, since closing at one end meant opening at the other. There were several serious objections to this system. It was very difficult to give the engine cushion enough to help the cranks over the centers without pounding, and a small degree of lost motion was sufficient to make the steam obstruct the piston during a portion of the stroke. But the most serious drawback to the short valve was, that it permitted no advantage to be taken of the expansive power of steam. For several years after the advent of the locomotive, the boiler pressure used seldom exceeded fifty pounds to the square inch. With this tension of steam, there was little work to be got from expansion with the conditions under which locomotives were worked; but so soon as higher pressures began to be introduced the loss of heat entailed by permitting the full pressure steam to follow the piston to the end of the stroke became too great to continue without an attempted remedy. A very simple change served to remedy this defect, and to render the slide valve worthy of a prominent place among mechanical appliances for saving power.

OUTSIDE LAP.

The change referred to, which so greatly enhanced the efficiency of the slide valve, consisted in lengthening the valve face so that, when the valve stood in the center of the seat, the edges of the valve extended a certain distance over the induction ports, as in Fig. 2. This extension of the valve is called outside lap, or simply lap. The effect of lap is to close the steam port before the piston reaches the end of the stroke, and the point at which the steam port is closed is known as the point of cut-off. When the steam is cut off and confined within the cylinder, it pushes the piston along by its expansive energy, doing work with heat that would be lost were the cylinder left in communication with the steam chest till the end of the stroke.

When a slide valve is actuated by an eccentric connected directly with the rocker arm or valve stem, the point of cut-off caused by the extent of lap remains the same till a change is made on the valve or on the throw of the eccentric, unless an independent cut-off valve be employed. Locomotives having the old hook motion worked under this disadvantage, because the hook could not vary the travel of the valve, which is the method usually resorted to for producing a variable cut-off. The link and other simple expansion

gears perform their office of varying the cut-off in this way.

SOME EFFECTS OF LAP.

In addition to cutting off admission of steam before the end of the stroke, lap requires the valve to be set in such a way that it has also the effect of leading to the exhaust port being opened before the end of the stroke. The point where the exhaust is opened is usually known as the point of release. The change which causes release to happen before the piston completes its stroke, leads to the closure of the exhaust port before the end of the return stroke is reached, which imprisons the steam remaining in the cylinder, causing compression. Where a valve has no inside lap, release and compression happen simultaneously; that is, the port at one end of the cylinder is opened to release the steam, and that at the other end is closed, letting the piston compress any steam remaining in the cylinder into the space left as piston clearance.

INSIDE LAP.

In some cases the inside edges of the valve cavity do not reach the edges of the steam ports when the valve is on the middle of the seat, but lap over on the bridge a certain distance, as shown by the dotted lines in Fig. 2. This is called inside lap, and its effect upon the distribution of steam is to delay the release. By this means it prolongs the degree of expansion, and hastens compression on the return stroke. Inside lap is an advantage only with slow-working engines. When high speed is attempted with engines having much inside lap, the steam does not have enough time to escape from the cylinders, and the back pressure and compression become so great as to be very detrimental to the working of the engine. As locomotive engineers have it, the engine is "logy."

THE EXTENT OF LAP.

In locomotive practice the extent of lap varies according to the character of service the engine is intended to perform. With American standard gauge engines, the lap varies from $\frac{1}{2}$ inch to $1\frac{1}{4}$ inch. For high-speed engines, the extent of lap ranges from $\frac{7}{8}$ to $1\frac{1}{4}$. Freight engines commonly get $\frac{5}{8}$ to $\frac{3}{4}$ outside lap, and from $\frac{1}{16}$ to $\frac{1}{4}$ inside lap. With a given travel, the greater the lap the longer will the period for expansion be.

## The Indicator Diagram.

BY F. F. HEMENWAY.

During the past ten years the steam engine indicator has come into comparatively general use, and will soon be considered an essential part of the equipment of every well-appointed engine room. But particularly within that time the indicator diagram has become so thoroughly incorporated with the current literature of the steam engine, expressing graphically what would often require pages of words, that those who are interested in the steam engine or in steam engineering, should be able to read the diagram, even though they have no occasion to interest themselves in the use of the instrument by which it is taken.

NAMES OF THE DIFFERENT LINES.

To do this it is necessary to become familiar with the different lines, which may not inaptly be called the alphabet of the diagram. These lines, referring to Fig. 1, which was engraved from a diagram taken in actual practice, may be designated as follows: *A*, *A*, is the atmospheric line, which although traced by the pencil of the indicator has no connection whatever with the cylinder of the engine. This is the neutral line of the diagram, representing the position of the pencil when both sides of the piston of the indicator are exposed to the atmosphere, hence it is the base line from which pressures either above or below it are measured; *a b*, the admission line, so called because its beginning, *a*, represents the beginning of the steam valve to admit steam to the cylinder. (It may prevent confusion to state, here, that the terms steam valves and exhaust valves will be used as though the engine referred to had four distinct valves, since the four edges of a common slide valve operate to all intents as four valves, connected so as to move together as one piece); *b c*, the steam line, usually considered as beginning at the point of positive change in direction of the admission line, and terminating at the point of cut-off, in this instance near *c*; *c d*, the expansion line, traced while the steam valve is closed and previous to the opening of the exhaust valve, the pressure falling by expansion; *d e*, the exhaust line, beginning with the opening of the exhaust valve and continuing to the end of the (relatively) forward stroke of the piston; *e f*, the line of counterpressure, drawn during the return stroke of the piston, and while the exhaust valve is still open, and *f a*, the compression line, drawn during the return stroke, after the exhaust valve has closed, continuing, ordinarily, up to the opening of the steam valve, at or near the beginning of the forward stroke.

The direction of the motion of the piston of the engine is always relatively the same when these lines are traced, with the single exception of the admission line. Thus the lines *b c*, *c d*, *d e*, are always traced while the piston is moving away from the end of the cylinder with which the indicator is connected, the lines *e f*, *f a*, when it is returning, while the line, *a b* may represent motion in either or neither direction, according to the arrangement and condition of the valve and valve motion. This designation of lines, it may be observed, is to a certain extent conventional, and is adapted more for convenience than for exactness of expression. For instance the admission line might with propriety be considered as continuing from the time of opening till that of closing of the steam valve, and the exhaust line from the opening till the closing of the exhaust valve, but they are more conveniently referred to when further divided, as noted.

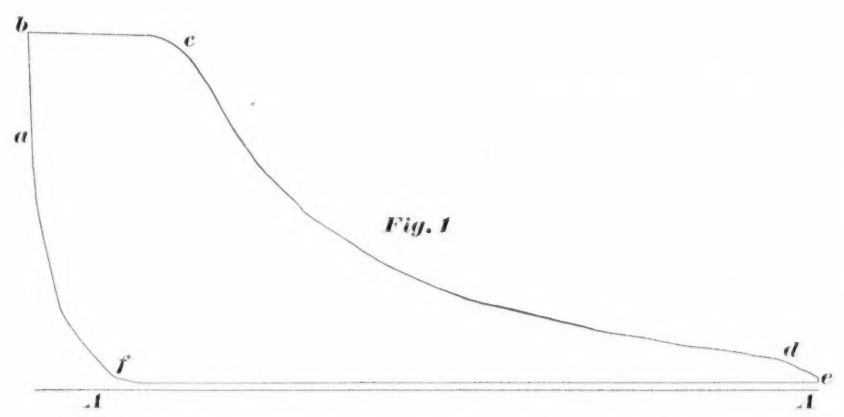


*Fig. 1*

The beginning and termination of some of the lines are considered as *points*, and their duration as representing *periods*, in the stroke of the engine. Thus *c* represents the point of cut-off, and from *c* to *d* the period of expansion, &c. Remembering that vertical measurements will represent pressures in the cylinder, and horizontal measurements positions of the piston, it is easy to determine the pressure at any of these points, as well as the time in the stroke at which they occur.

DATA NECESSARY OR USEFUL.

But as this is only a small part of the language of the diagram, it is necessary that several things having reference to permanent and accidental conditions be known. Those absolutely essential are: the scale of the indicator spring, the diameter of the engine cylinder and the stroke of the piston, the diameter of piston rod, and the revolutions of crank shaft per minute. Those only less important—sometimes equally so—are: the boiler pressure, the diameter and length of steam and exhaust pipes, with the number and character of bends as well as other features that may tend to influence the flow of steam. When possible the dimension of steam and exhaust ports should be known, and the general features of the valve construction and motion; in fact any conditions that will influence the distribution of steam in the cylinder, as it is only by knowing these that cause and effect can be connected. The clearance should also be known, since establishing this from the diagram is a matter of uncertainty, even an approximation being frequently an impossibility. If a condensing engine, the vacuum, by gauge, should be noted, and the temperature of hot-well, diameter and stroke of air pump, size of injection and discharge pipes and temperature of injection water. Diagrams are often practically worthless because so little is known of the conditions under which they were taken, hence those taking them should make the data as complete as possible. When this is done their study is a pleasure as well as a profit, affording, by comparison the effects of different forms of construction and ways of operating.

The most natural operation, after becoming familiar with the signification of the different lines of the diagram, is to determine from it the horse-power developed by the engine, for which purpose, to avoid confusion of lines, another diagram will be substituted.

## Iron and the Industrial Situation.

There are three features in the industrial situation, of very recent development, deserving of attention. First, the moderate degree of speculative inquiry for crude iron. Second, the development of a number of enterprises likely to call for a large quantity of iron and steel material; and, third, a fresh impetus that has been given to investments in manufacturing enterprises.

It is probable that the first indication will blow away; that the second will lead to an increasing demand for material during the current year, and that the third will result in the building up of a considerable number of minor industries, which in turn will open the way for a much wider market for iron and steel than at present exists.

A fourth matter, outside of these, which is deserving of attention is the probability as to the building up of a domestic tin-plate industry. If the desired duties are placed, a very heavy demand would spring up, which would be felt, not only in the iron trade, but in the ore and coal interests. As to the wisdom of resorting to legislative remedies for any one industry from the bottom, opinions differ. The tin-plate industries are well organized, and have the consuming interests largely with them. The importing interests will offer vigorous battle, and use arguments which will find ready acceptance with a large number of Congressmen.

The Bessemer steel rail interests have entered the year 1884 under excellent conditions. All through the closing months of the year buyers held back, and in consequence prices weakened, and at the right time the buyers presented their requirements upon the market, and as the result the Bessemer mills are sold up for the winter.

The demands for structural iron are still largely in abeyance, but, as stated above, there are a number of important enterprises pushing themselves to the front, and likely to get there, which will call for large quantities of iron and steel for structural purposes, such as bridges, ships, elevated railways, and buildings.

The sheet mills have less business than usual.

The bar mills are slowly struggling into an improving trade.

Two structural mills are prepared to furnish steel shapes about as cheap as iron shapes have been heretofore furnished. This is only another of those developments of the ability of steel to crowd out iron.

The blast furnaces are barely able to make the two ends meet.

All the Southern furnaces are sold ahead. Comparatively few Northern furnaces are so well fixed.

Prices are weak, but it is thought will not be likely to go lower.

A few Pennsylvania furnaces are threatening to resume.

Buyers higgle over prices and buy only for pressing requirements. But little foreign material is arriving, and foreign markets are weak.

A few blast furnaces in Pennsylvania have received inquiries for large lots of iron, and in a few cases offers, but on a basis which would scarcely cover cost. The willingness to purchase, in a speculative way, is, as far as it goes, a favorable indication for the trade.

All the bridge works are crowded with business. The car works are well supplied with orders, especially in Pennsylvania and Ohio.

A year ago announcements of new iron works were frequent, but at present a more conservative sentiment prevails, and until a very different condition of things develops, the present producing capacity of mills and furnaces will not be increased.

## Railroad Snow Plowing.

The following letter, received from the veteran master-mechanic, G. W. Cushing, superintendent of machinery of the Northern Pacific Railroad, whose experience of snow working is probably unparalleled, is so seasonable that we give readers the benefit of the points made:

NORTHERN PACIFIC RAILROAD,
Office of Superintendent of Machinery,
ST. PAUL, Minn., Jan. 11, 1884.

ANGUS SINCLAIR, ESQ.,
*American Machinist:*

I was greatly interested by your article in AMERICAN MACHINIST on "Railroad Snow Plowing." The snow plow shown is substantially the same as I have used for twenty-three years. Some changes for convenience, in handling and adjustment, have been made, all as shown in your engraving, which I suppose is taken from the reports of the Master Mechanics Association of some years back. By reducing height of plan and altering form, better action is had in snow banks. All that is really required is to give proper direction to the snow drift. The velocity and weight behind does the business. Very much of what you say comes home as past experience, and especially do the points made relative to the care and disposition of *men* and *engines* employed in the snow party.

The limit of safety is well put, as some of us—who, in anxiety to clear the road, have exceeded it in use of as many as five engines in a gang—have learned by sad experience. Our friend, Bushnell, is one of these, if memory serves me correctly.

But, after all is done, in the way of supplying the best machinery, its effective working depends upon the judgment and nerve of the engineer to an extent appreciated only, perhaps, by those who have been 'foremost in the fight,' and one who has not 'been there' will hardly appreciate your remark about 'plunging into a solid bank of snow the height of the smoke stack.' This is often done now-a-days, at a fifty-miles-an-hour gait, with two engines coupled. There is nothing to equal the excitement this creates, probably, and its effects upon the men who often practice it are noticeable.

I am pleased that you take up those practical matters in railroad experience; they are put in shape, valuable especially to our young men. More than all am I glad to note one appreciative friend of the engineer in position to make his opinions felt.

G. W. CUSHING.

To illustrate the difficulties of providing a reliable test for cast iron car wheels, a speaker at the Car Builders' Club mentioned a case where the wheels of a certain maker had run splendidly for years. He made the pattern heavier to meet the increased loads, and the wheels were worthless.

## The Hammer.

BY JOSHUA ROSE, M. E.

(From a Lecture Delivered Before the Franklin Institute.)

* * * The hammer is generally known as a rude instrument, but as a matter of fact it is in some of its uses a very refined one, requiring great care and skill in its use. * * *

Time forbids that I should refer to more than a few of the more prominent forms of hammers. The carpenter's mallet has a large rectangular head, because, as his tools are held in wooden handles, he must not use a hard substance to drive them with, or he will split the handles. Wood being light, he must have a large head to the mallet in order to give it weight enough.

THE STONE MASON'S MALLET.

The stone mason uses a wooden mallet, because it delivers just the kind of dull blow that is required. His mallet head is made circular, because his tools are steel, and have no wooden handles, and he is able to use the whole circumference, and thus prevent the tools from wearing holes in the wooden mallet face. The handles of both these mallets are short, because they will strike a sufficiently powerful blow without being used at a great leverage. On the other hand, the stone breaker's hammers have long handles, to avoid the necessity of stooping. The pattern maker's hammer is long and slender; long, that it may reach down into recesses and cavities in the work, and slender because, being long, it has weight enough without being stout. Now take the blacksmith's sledge, and we find the handle nearer to the pene, or narrow end, than it is to the broad-faced end; while the pavior's sledge has the handle in the middle of its length. If we seek the reason for these differences, it will readily occur to us that the blacksmith's helper or striker delivers most of his blows in a vertical direction, and uses, mainly, the face and not the pene of the hammer; and by having the eye, and therefore the handle, nearest to the pene end, the face end naturally hangs downwards, because, as held by the handle, the face end is the heaviest; and, as a result, he needs to make but little, if any, effort to keep the face downwards. The pavior's work, however, lies near the ground, and he uses both faces; his hammer not requiring a pene, hence the handle is placed central, balancing both faces equally.

THE MACHINIST'S HAMMER.

The machinist's hammer is also made heavier on the face than on the pene end, so that the face which he uses the most will hang downward without any special effort to keep it so. His chipping hammer (which he also uses for general purposes) weighs, in the heaviest kinds, $1\frac{3}{4}$ pounds, and the handle should be fifteen inches long. He wields it, for heavy chipping, with all the force he can command, obeying the law that it is velocity rather than weight that gives penetration. Thus, suppose that a hammer weighing 100 pounds is traveling at a velocity of ten feet per second, and the power stored up in it is 1,000 foot-pounds. Another hammer, weighing one pound, and traveling 1,000 feet per second, would also have stored up in it 1,000 foot-pounds. Hence the power is equal in the two, but the effects of their blows would be quite different. If they both struck a block of iron, we should find that the effects of the quick-moving hammer would sink deeper, but would spread out less sideways, giving it a penetrating quality; while the slow-moving one would affect the iron over a wider area, and sink less deeply. To cite an important operation in which this principle must be recognized: Suppose we have a wheel upon a shaft, and that the key is so firmly locked between the two that in driving it out we know that, if we take a heavy hammer and strike slow-moving blows, we shall spread the end of the key, riveting it up and making it more difficult to drive out, so we take a hammer having less weight, and move it quicker.

USES OF THE HAMMER.

In whatever form we find the hammer it is used for three purposes only; namely, to crush, to drive, and to stretch. And the most interesting of these operations are stretching and driving. The gold beater, the saw maker, the blacksmith, the plate straightener, and the machinist, as well as many others, employ the hammer to stretch; while the carpenter, the machinist, and others too numerous to mention, use the hammer to drive. Among the stretching operations there are many quite interesting ones.

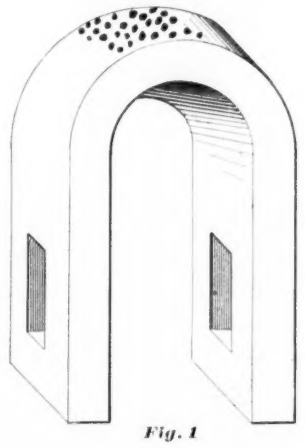


*Fig. 1*

Here, Fig. 1, for example, is a piece of iron, two inches wide and an inch thick, bent to the shape of the letter *u*. This piece of wire is, you observe, too short to fit between the jaws, and I will now bend the piece and close the jaws by simply hammering the outside of the curved end with a tack hammer. The proof that the blows have bent the piece is shown, because the piece of wire now fits tightly instead of being loose, as before the hammering. The principle involved in this operation is that the blows have stretched the outer surface, or outside curve, making it longer and forcing the jaws together. If we perform a similar operation upon a straight piece of metal the side receiving the blows will actually rise up, becoming convex and making the other side concave, giving us the seeming anomaly of the metal moving in the opposite direction to that in which the blows tend to force it. This process is termed pening, because, usually, the pene of the hammer is used to perform it. It is sometimes resorted to in order to straighten the frame-work of machines, and even to refit work that has worn loose.

STRAIGHTENING PLATES.

Straightening thin metal plates and saws form very interesting examples of the stretching process, and are considered very skillful operations. Some few years ago I was called upon to explain the principles involved in this kind of straightening, and having no knowledge of the subject I visited a large saw factory to inquire about it. I was introduced to one of the most skilful workmen, and the object of my visit was made known to him. He informed me that it was purely a matter of skill, and that it was impossible to explain it. "I will show you how it is done," said he, and taking up a hand-saw blade, he began bending it back and forth with his hands, placing them about eight inches apart upon the blade. "What do you do that for?" I asked. "To find out where it is bent," he replied. * * *

I spent two hours watching this man, and questioning him, but I left him about as much in the dark as ever.

Then I visited a large safe making factory, knowing that the plates for safes required to be very nicely straightened. The foreman seemed very willing to help me, and took me to the best straightener in the shop, who duly brought a plate for a safe door and straightened it for me. Then he brought another, and as soon as he stood it on edge and began to sight it with his eye, I asked him why he did that. "Because the shadows on the plate disclose the high and the low patches." "In what way?" I asked. "Well, the low patches throw shadows," he replied, and the conversation continued about as follows:

"When you have thus found a low place, what do you do?"

"I hammer it out."

I sighted the plate and made a chalk mark enclosing the low spot, and he laid the plate upon the anvil and struck it several blows.

"Why did you strike the plate in that particular spot?" I asked.

"Because that is where I must hit it to straighten it."

"Who told you that this particular spot was the one to be hammered?"

"Oh! I learned that years ago."

"But there must be some reason for selecting that spot, and that is what I want to find out."

"Yes, I suppose there is a reason for it, but if it had been a different kind of a hollow place, I wouldn't have hit it there at all."

"Why not?"

"Because I should have had to hit it somewhere else."

And so it went on until finally I got some pieces of twisted plate, one with a bulge on one edge, another with a bulge in the middle, and he straightened them while I kept up my questions. But still the mystery remained, nor did I see any nearer to a solution, so I abandoned the attempt.

About six months after this I met, by chance, an Eastern plate straightener, and on relating this experience to him, he offered to go into the shop and explain the matter.

We went, and taking up a plate about $\frac{1}{8}$ inch thick, two feet wide and four feet long, he laid one end on an anvil and held up the other with his left hand, while with his right hand he bent, or rather sprung, the plate up and down, remarking as he did so: "Now you just watch the middle of this plate and you will see that as I spring it the middle moves most, and the part that moves most is a *loose place*. The metal round about it is too short and is under too much tension. Now, if I hammer this loose place I shall stretch it and make it wide, so I hammer the places round about it that move the least, stretching them so that they will pull the loose place out. Now, with a very little practice you could take out a loose place just as well as I can, but when it comes to a thick plate the case is more difficult, because you cannot bend the plate to find the tight and loose places, so you stand it on edge, and between you and the window, the light and shades show the high and low patches just as a landscape shows hills and valleys."

I selected several examples of twisted and crooked plates, and he straightened them for me, explaining the reasons for each step in the process, and as this forms one of the most interesting operations performed by the hammer, I may, as well speak somewhat in detail of hammers, the way they are used, and the considerations governing their application to the work.

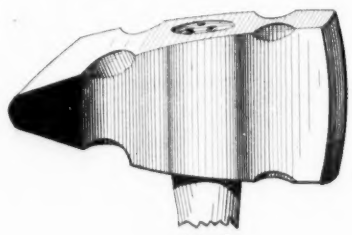


*Fig. 2*

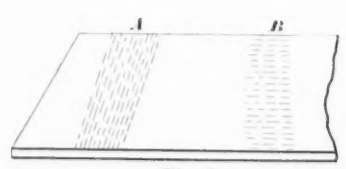



*Fig. 3*

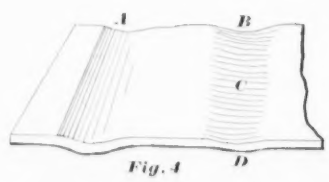



*Fig. 4*

Fig. 2 represents what is called the long cross-face hammer, used for the first part of the process which is called the smithing. The face that is parallel to the handle, is the long one, and the other is the cross-face. These faces are at a right angle one to the other, so that without changing his position the operator may strike blows that will be lengthways in one direction, as at *A*, in Fig. 3, and by turning the other face towards the work he may strike a second series standing as at *B*. Now, suppose we had a straight plate and delivered these two series of blows upon it, and it is bent to the shape shown in Fig. 4, there being a straight wave at *A*, and a seam all across the plate at *B*, but rounded in its length, so that the plate will be highest in the middle, or at *C*, if we turn the plate over and repeat the blows against the same places, it will become flat again.

FORM OF HAMMER.

To go a little deeper into the requirements of the shape of this hammer, for straightening saws, I may say that both faces are made alike, being rounded across the width and slightly rounded in the length, the amount of this rounding in either direction being important, because if the hammer leaves indentations, or what are technically called "chops," they will appear after the saw has been ground up, even though the marks themselves are ground out, because in the grinding the hard skin of the plate is removed, and it goes back to a certain, but minute, extent towards its original shape. This it will do more in the spaces between the hammer blows than it will where the blows actually fell, giving the surface a slightly waved appearance.

The amount of roundness across the face regulates the widths, and the amount of roundness in the face length regulates the length of the hammer marks under any given force of blow. As the thicker the plate the more forcible the blow, therefore the larger the dimensions of the hammer mark. * * * This long cross-face is used again after the saws have been ground up, but the faces are made more nearly flat, so that the marks will not sink so deeply, it being borne in mind, however, that in no case must they form distinct indentations or "chops."

John E. Wootten, general manager of the Philadelphia and Reading Railroad, has patented an improvement on his well-known locomotive fire-box. The change consists of a combination in a laterally-extended fire-box of a fire-bridge and a table, or repository, made of fire-brick or other refractory material, extending rearwardly from the bridge and across the fire-box. It seems to be substantially a convenient way of covering the front of the grates, to prevent access of air close to the bridge.

## Personal.

H. L. Perrine, formerly with the Davidson Steam Pump Company, has accepted a situation with Henry R. Worthington. Mr. Perrine will be absent from the city much of the time, on business connected with the Worthington pumps and pumping engines.

## Iron Locomotive Cab.

The Grant Locomotive Works, Paterson, N. J., are building a small locomotive of the Forney type for the Rensselaer Iron Works, which will have a novelty in the shape of an iron cab. The engine will be used for switching about the works and in drawing cars between the rolling mills and the steel works, which are some distance apart, and it has been deemed appropriate that iron and steel should be used as much as possible in the construction of the locomotive. The cab is built in the ordinary style, with a rounded top which is seven feet above the deck of the engine. The material used is $\frac{1}{8}''$ sheet iron, which is bound by small angle iron. The windows and doors are large, and are secured with neatly-fitted iron fastenings. In appearance this cab does not differ materially from the ordinary wooden one, except that the mouldings are absent.

This engine has a pony truck under the deck, and the radial bar passes forward below the fire-box.

The Grant Works are turning out some heavy consolidation engines for the New York, Pennsylvania and Ohio Railroad. Business is so slack that the working hours have been reduced to eight hours a day.

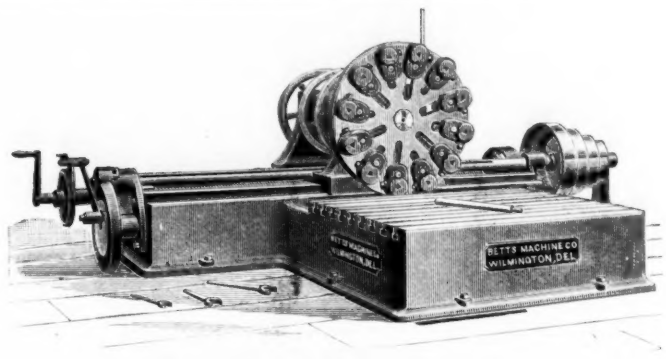
### Twenty-four Inch Rotary Planer.

The engraving represents a rotary planing machine, built by the Betts Machine Company, Wilmington, Del. It is designed for facing columns, chords—and, in fact, for all kinds of end facing on bridge and architectural work—and is useful for many kinds of heavy engineering work.

The spindle is of cast steel, running in gun-metal boxes, and has an end adjustment of 2″, which permits the cutter head to be adjusted to the work without the necessity of moving the latter. The spindle is driven by a worm and wheel, through a friction clutch, which permits the cutter head to be disconnected for convenience of setting the cutters. The spindle and head is carried in a frame that traverses the bed plate, the work remaining stationary. It is provided with automatic variable feed and an independent motion for moving the head back. The cone pulley has four speeds, for 3½-inch belt.

The cutters are adjustable, so arranged that when facing to the maximum diameter of two feet 24 are used, and when this is reduced to eight inches diameter, 6 cutters are used.

This machine will face a surface of 3½ feet in length by 2 feet in height, and for work which can be done with such a machine, including in many cases heavy machine-shop work, is a very convenient and rapid-working tool.




TWENTY-FOUR INCH ROTARY PLANER.

### One Advantage of American Machinery.

Lionel Garden, a British consul in Mexico, says, in a recent report: "In a general way, it may be said that it is the weight of English machinery which places it at such a disadvantage when compared with that from other countries, and especially from the United States. In Mexico, owing to the enormous freights, and the great expense of handling, it often happens that bulky articles of no great value have to pay for transport alone, from the factory to the City of Mexico, from 50 to 100 per cent. of their original cost, independent of the duties (if the goods are dutiable) and other charges and commissions, and independent also of the further cost of transport to their ultimate destination. It stands to reason, therefore, that the lighter a machine can be built, without prejudice to its strength and durability, the better it is suited to this market; and the position that American machines occupy here to-day is due, in very great measure, to the recognition of this fact by American manufacturers."

### Observations on Machine Tools.

BY "MARCUS."

A short time ago I wrote you that I would give my ideas about the "anvil principle" in regard to machine tool construction. At this time I will confine myself more particularly to lathes.

In my experience I have found that of two classes of lathes—for instance, one light and handy, and the other heavy and clumsy—the workmen, if they can have the choice, will almost always take the light lathe, for the ordinary run of work on lathes 24″ and under. On heavy work a stiff lathe counts, as the work being larger does not require changing so often, so that a little more time spent in setting tools and other necessary changes is more than made up in the larger cuts and coarser feeds.

It takes more power to run the heavy machine than it does the lighter one, on account of friction, and on tool work and work of a similar character the stiff, heavy tool is not sensitive enough to the touch.

In nine-tenths of the shops the lathes, as made at present, are plenty heavy enough for the ordinary run of work; especially so is this true of New England. In gun and sewing machine factories the lathes are too heavy, and most of the tool makers prefer a weighted carriage to the gib carriage.

I believe in making machinery fully as stiff and heavy as can be done and not sacrifice any of the elements that go towards making it handy, that we have been used to in the past. This feature has made us able to compete with other countries on our lighter class of metallic goods. Of course there are a good many places where the heavy tool would be better than the light one, but it does not follow that because we have some work suitable for heavy lathes, *all* the lathes in the shop must be heavy.

* * * * * * *

I am longing to see the time when our machine tool builders will have a convention and take steps to bring about uniformity. Lathes of the same size will then have the same size and taper for centers; the nose of the head spindle will be so that the face plates of one make of lathe will correspond to and interchange with those of another make, so that when a chuck or special face plate is made to one lathe it will fit on any. A great deal of time is lost by workmen having to change the face plates on chucks, so that they can be used on their lathe, after some other workman has been using it on some other make of lathe. Then, again, a chuck cannot be kept true in being changed so much.

Another thing, that ought to be made to correspond, is the lead screws. I spent half a day, one time, trying to find a lathe that would cut a screw to a gauge that I had, and was obliged to give it up. There was not one lathe in the shop that would cut exactly the same thread as any other.

Nine-tenths of the screws made do not correspond perfectly with the taps. To prove this, tap out a hole two inches deep and then try to run in a screw that is a good fit for the first half inch. The chances are that you would not be able to screw it in the full depth.

The lead screw should never be used for anything but cutting threads, as it will soon wear uneven. There ought to be some standard to work from. I believe that the Pratt & Whitney Company have got as near a perfect screw as there is, and if all the other tool builders would buy a screw of them, to be used only for cutting their lead screw, and to be renewed as often as necessary, it would be a great step forward in the right direction. It is not so much the possession of a perfect thread as it is having all the different lathes cut the same thread. Of course the more perfect the thread the better.

I think it would pay to give our tool builders a rest on the "anvil principle" and give them a dose of interchangeability, until they come up to the scratch.

### A British View of the Tariff.

We clip the following from the *Machinery Market*, an English journal published in the machinery interest:

"The year is likely to see important political changes on the other side of the Atlantic, which will have their influence on business here. Events move rapidly in America, and the coming triumph of the Democratic party there means the triumph of the Free Trade movement in the States.

"It is not to be supposed that there will be free imports into the States, but 'a tariff for revenue only,' which is the leading cry of the Democrats, will open an immense additional field for the sale of English manufactured goods in the States."

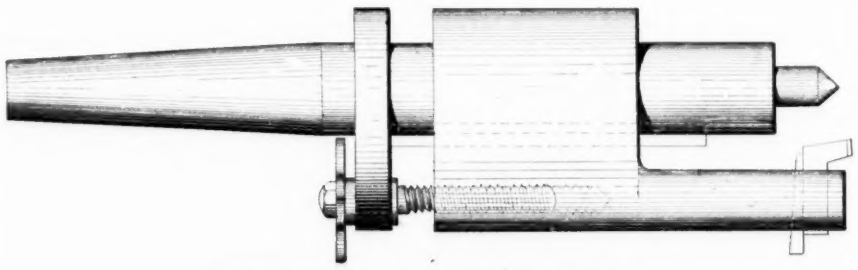
## LETTERS FROM PRACTICAL MEN.

### Device for Truing Lifting Shaft Bearings.

*Editor American Machinist:*

Having been greatly interested, as well as benefitted, from the numerous illustrations and descriptions of devices for small tools for special use which have appeared from time to time in your valuable paper, I herewith offer a sketch of a tool for truing up the bearings of the lifting shaft of a locomotive engine, hoping others may find it as serviceable to them as it has proved to us. Most foremen of railroad shops, as well as the machinists who have to do with these things, have felt the want of some arrangement by which they could do this work without resorting to the "big lathe," or bending the arms to have the shaft swing in a smaller one. The writer once found himself in this strait, but got himself out of it in this wise: In a small shop with no lathe that would swing a lifting shaft without bending the arms, and with no convenient way of bending and straightening them, he had either to send it to the main shop or devise some method to do it with the means at hand. An old exhaust tip helped him out of his difficulty. Having one that bolted to the pipe with two lugs, he fastened a cutter or tool to the outside of this, and attached the tip to the face plate of the lathe by the lugs, and securing the lifting shaft to the slide rest the truing of the shaft was an easy matter. This tool was in use a number of years, but the lifting shaft being so much longer than the rest upon which it was fastened it was liable to shift, and get out of true, and required considerable care in adjusting. To relieve himself of this trouble, and to save time, our lathesman devised a tool (of which the sketch herewith is a representation), by which the truing of the bearings of a lifting shaft is as easily done in a small lathe as a straight shaft. If others can make use of it, or present something better for the purpose, we shall be glad to know it. The device is so plain as to require but little explanation. As you will see, the tool is attached to a sleeve which slides on a small shaft; this shaft forms the center of the lathe, and is fitted to the spindle of the lathe as a center. The lifting shaft is hung on the centers, and is ready for truing. Any convenient attachment to the lathe to trip the star gives the feed. We have found this a very convenient tool, and do all of this kind of work with it.

MASTER MECHANIC.



DEVICE FOR TRUING LIFTING SHAFT BEARINGS.

### A Curious Explosion.

*Editor American Machinist:*

A curious explosion took place in our shop—the C. & G. T. Ry.—the other evening, for which we are at a loss to account. We have a lot of solid pistons in our engines, that is, the piston head, follower, &c., are all cast in one piece, which is hollow. The core holes are plugged, so the whole forms a hollow casting, air tight. The ⅜″ dowel pins that hold the piston rings from turning, often break off, and a hot piston comes in to have the dowel pins drilled out. Always when the drill goes through it lets out a charge of air (or something else) which is under great pressure, judging from the way it comes out. The other evening a piston came in to have the pins drilled out. The drill press boy took his center punch to "spot" it, and noticed when he struck it that it was driven partly in. One man held the piston and another a torch, close to the pin, for the boy to see by. Next blow he struck the pin went *in* or *out* (it was never seen), and there was a tremendous explosion, which knocked the boy heels over head, and kicked the piston off the drill press. The explosion was followed by a roar not unlike a locomotive pop valve blowing off steam, only louder, and accompanied by a stream of fire from the hole where the pin came out. It roared two or three seconds, then died out. Evidently *something* came out and caught fire from the torch, and exploded. The piston contained a lot of black grease, which was, most of it, on the men's faces at the conclusion. All the other pistons have been dry inside. Can you tell, us through your paper, what exploded, and where it came from? If so we will be much obliged, and look out for the infernal thing next time.

REVERSE GEAR.

[Our impression is that the explosive mixture was a gas, formed from mineral oil that found its way inside the piston.]

### "The First Practical Steam Engine."

*Editor American Machinist:*

In your issue of January 12th, an article with the above title, though very interesting was hardly explicit enough for a great many of your readers. There is no doubt but Thomas Newcomen was a great mechanic in his time, but like some mechanics of the present was benefitted more by the inventions of others than by his own. To prove my statements it will be necesary to go back several centuries. It can readily be seen that Newcomen's engine was a combination of earlier ideas. Again, he never "harnessed steam" but the atmosphere. This may be a bold assertion, but I think a careful study of the subject will convince all, that with two exceptions no engine was built using the force or pressure of steam until several years after Newcomen's death.

One of the above named exceptions, by Hero, B. C. 200, was no more than a toy, and the second, invented by Branca, patented in 1629, but little better. A patent was taken out by Edward Somerset, the second Marquis of Worcester, in June, 1663, for a pumping engine by which he used to raise water at Raglan Castle. It was about the year 1678 that the piston and cylinder were first applied to the heat engine by Jean Hautefeuille, and Huyghens applied the same to his powder engine in 1680.

Thomas Savery took out a patent in 1698 for a vacuum engine. In the year 1695, Denys Papin experimented some, using to a slight degree the direct force of steam, but depending mostly on the vacuum. One of his engines was so far perfected that he used it to propel a boat.

It was not till 1705 that Thomas Newcomen appeared with his machine, which was the engine of Huyghens, with its cylinder and piston as improved by Papin, and the substitution of steam for the gases generated by the explosion of gunpowder. This was still further improved by Newcomen and

Calley, by the addition of the method of condensation used by Savery. It was still further modified with the object of applying it directly to the working of pumps by the overhead, or walking, beam, with the piston attached to one end and the pump at the other. The weight of the pump rods raised the piston in the cylinder, which was drawn back by forming a vacuum beneath it.

There is no doubt that Newcomen in company with Calley first invented and attached the walking beam to the atmospheric engine, and this was the only invention of theirs that was of importance. Some biographers go so far as to state that Newcomen was at one time employed by Savery in making some of the more intricate forgings of his (Savery's) engine.

It was not until 1775 that steam was really harnessed and set at work by James Watt, who as early as 1767 proposed to cover the top of his cylinder and admit steam upon the top and bottom of the piston, alternately.

A drawing was laid before the committee of the House of Commons in 1774–75. All engines previous to this (with the exception named) were atmospheric or vacuum engines. A work written by Robert L. Galloway, in 1881, states that Thomas Newcomen died at London in 1729 of a fever, after a fortnight's illness.

PACKING.

### Cleaning Boilers.

*Editor American Machinist:*

While they are building boilers in columns of the AMERICAN MACHINIST, I would like some brother engineer to tell us how to clean out boilers properly after they become scaly. I find a hatchet a mighty handy tool in some places. I have no faith in compounds.

Nashville, Tenn. ENGINEER.

### How Brown Put a Dome on a Boiler.

*Editor American Machinist:*

I stopped at Brown's boiler shop the other day, and had quite an interesting visit. Brown is one of the firm and foreman of the boiler shop. In addition to the latter there is quite a nice machine shop, foundry, blacksmith and pattern shop.

Brown was originally a horse shoer, but was coaxed to try machine blacksmithing, and from that time took to flange turning, and in time became foreman. That was thirty years ago, consequently Brown has had thirty years' experience as a boiler maker. He has the reputation of doing first class work, and is considered the best boiler maker in the city. He had a dome to put on top of a boiler, and while I was there I saw them do it. A sheet of iron about 30″ wide was rolled up, first having been punched on the ends, and one side, then the plain ring was placed on the top of the boiler and leveled! Yes, sir, leveled with a spirit level! Wedges were introduced at each side to hold the dome in its position, and then Brown got on his glasses, set his compasses and scribed the vertical circle according to the shape of the horizontal one. I had always imagined that the work in a boiler shop was done in a loose manner, but seeing what I did convinced me that the art of boiler making did not get the credit it deserved.

Just think of it, a spirit level being used in a boiler shop; and I had always heard that anything was good enough for a boiler maker. Well, after the vertical course was taken off, it was marked with a center punch and Brown again got his dividers and marked out the flange line. The circle was then taken to the punch and pieces punched out to conform to the shape of the shell of boiler, and from there it was taken to the flange fire and Brown turned the flange. I forgot to say that in fact Brown did all the work I have so far described, and had four men waiting on him all the time. That dome fitted on the boiler first rate; it was a perfect fit. The holes were then spaced off by Brown with a pencil, regardless of equity, and then the punch was again called into requisition. The flange being punched the dome was again placed on the boiler, and Brown the indefatigable again went to work, marking through the holes in the flange on the shell by means of a piece of round wood dipped in a white lead preparation.

I forgot to mention that the spirit level was first used on the head of the boiler, also on the dome, so as to insure the one being plumb with the other. This being completed the dome was taken down and Brown centered every one of the marks in four or five different places, and then surrendered his job to two young fellows, who with hammers and chisels went to work cheerfully to cut out the holes.

They had a good rest while Brown was working; it was Brown's turn to rest now. I told Brown I never had the pleasure of seeing how domes were developed before that time, and expressed myself as very interested in the matter. The old man seemed pleased at my remark, and replied that he had heard of some young follows who pursued a different method, but as far as he was concerned he intended to stick to the old way. Perhaps some of your boiler making readers, Messrs. Editors, can learn something from this. I am going to call there often, and may again give you some more points. Brown don't read the papers, so I don't think he will know I am exposing his secrets.

ANCIENT.

### The Wheel Question.

*Editor American Machinist:*

In your issue of December 15, G. F. E. asks: "Does a piston of a moving locomotive move backward and forward, and does the top of the locomotive wheel move faster than the bottom?" He is answered that "all parts on the circumference of a rigid wheel must move at the same velocity, if the axle is placed in the center."

As a subscriber, who makes a point of always reading "Questions and Answers," and gathering much information therefrom, I take the liberty of looking at this matter from another point of view. Of course, when a locomotive has run a mile, every part of it has moved a mile; but, considering the motion at any instant, it is plain that the point on the circumference of the wheel in contact with the rail is for the instant at rest, so that the whole wheel may be considered as rotating about this point, called the "instantaneous axis." This being the case, any point in the wheel is moving, at the instant considered, with a velocity proportional to its distance from the instantaneous axis. For instance, the top of the wheel is moving twice as fast as the center. Perhaps this is what G. F. E. had in mind.

The first part of his question reminds me of that of a student who, when informed that a ball fired from a gun on a railway train, with a velocity equal to that of the train, and in the opposite direction, would simply fall to the ground, asked whether, if the gun were pointed in the same direction as the train, the ball would leave the barrel at all!

THOMAS W. FRY.

### Feather Edges on Patterns.

*Editor American Machinist:*

In making a pattern that is to be used constantly, it is very desirable to have it made as strong and durable as possible, with suitable draw-irons, and with no feather edges to be curling up and getting split off after being in the foundry a day or so. Of course the cores will all be let into the pattern when that is possible, but such is not always the case, and it is a well-known fact that the ordinary glue will not hold a feather edge down long after it has been in the wet sand. Is there a pattern-maker in all this broad land who has not been discouraged by seeing the pattern that he has taken such pains with, and spent days and weeks to complete, brought in from the foundry with the feather edges on some of the cores all peeled up or split off, just because the pattern was wanted in a hurry, or the core was in a place where it could not be let in without a good deal of trouble? So the new pattern has to be patched up with beeswax, which answers very well for a time.

One of the boys in the shop had a receipt for waterproof glue, and as it seemed very simple, an experiment was made to determine if it was really what it purported to be. One ounce of potassium bichromate was dissolved in half a teacupful of water, and about three per cent. of this mixture added to common glue and thoroughly stirred. Two pieces of wood were glued together with this, and the next day one of the pieces was planed down to a fine thin feather edge where the joint was. This was on Saturday, and it was taken into the foundry and buried in the hot wet sand till Monday, when it was uncovered, and being still wet it was thoroughly dried; and as the edges were still in good shape, it was soaked for the rest of the day in the water tank, and dried as before. After this the joint was found to be as good as new, and the edges showed no signs of curling up or peeling off. The experiment was not carried any further, as that was probably as severe a test as any ordinary pattern would have to undergo. If this preparation was used occasionally, when necessary, it might save time, and possibly profanity, on the part of the moulder. The potassium bichromate is cheap—about 20 cents per pound—and can be obtained at any drug store.

C. R. C.

### Technical Education.

*Editor American Machinist:*

Of late there is considerable talk about technical education, and about a subject of such vital importance to the producers of this country, it is well there should be.

During the last of my school days, I attended a graded school of no small notoriety in that part of the country in which it is situated. It was under the supervision of a most excellent principal, but it had one grievous fault, which I think is common to all schools of that class, viz: A scholar was held back in some studies, because he was not up to the standard in some others, which the Board of Education had decided should be concomitants of the first. So, because I was not bright in Grammar, I was not allowed to study Geometry, and only by a special interposition, was I allowed to study Natural Philosophy,

I do not intend to convey an idea that the simple study of either Philosophy or Geometry, as taught in common schools, is of much benefit to a person after he enters the shop, but it certainly would be of more use to a mechanic in earning his living than all the Grammar, or what not, he might be able to cram with.

One day a young friend came in the shop, and said I, "How are you getting along in school?"

"Oh!" said he, "I have done so and so, and so and so, and among the rest been through five books of Geometry."

So I handed him a pair of compasses, a straight edge, and a piece of board, and said, "Let's see you make a square."

"Oh! I can't, I never learned that."

If that is the way they teach the useful sciences in the schools, I do not know as I was debarred from so much after all.

CHAS. S. BEACH.

Bennington, Vt.

### Organization and Progress of a Mutual Relief Association.

*Editor American Machinist:*

As mutual relief societies are becoming established features of well-regulated shops throughout the country, a few facts concerning the organization and operations of the Mechanics' Mutual Relief Association of the Morse Twist Drill and Machine Co. in this city, may be of interest to the many readers of the AMERICAN MACHINIST.

While the employes of the Twist Drill Co. have always been liberal towards their fellow-workmen when in distress, it was thought advisable to have an organization, and a system in giving which should more evenly distribute aid, as well as to give one the feeling that he was receiving something to which he was entitled rather than of being an object of charity. Before the association was formed it was the custom to carry a subscription paper around the shop. Sometimes a large sum would be obtained in this way, and sometimes a smaller amount, according to the popularity of the party or the nearness to pay day.

The first meeting of employes looking towards the formation of an association was held about the last of Nov. 1882, and before the close of the year an organization had been effected upon a very liberal basis, in which a large proportion of the workmen had enrolled their names. By the rules of this association its management was placed in the hands of a President, Vice-President, Treasurer, Secretary, and a board of five directors, to be chosen annually in January. All members were divided into two classes. Class A consisted of all persons 21 years of age and upwards. Class B consisted of those under 21, including also female employes of the company. Members of Class A were to pay fifty cents on joining the association, and a like amount at each assessment. Class B members were to pay 25 cents on joining, and at each assessment.

Any member of the association, prevented by sickness or accident from attending to his or her regular employment, unless the same was caused by intemperance or immoral conduct, could draw the sum of $9 per week, if a member of Class A, or $4.50 if a member of Class B. If disabled more than 4 weeks of working days, members of Class A were entitled to $1.50, and members of Class B were entitled to 75 cents for each working day of their sickness. In no case were benefits to be paid for a less period than one week, thus requiring a member to be disabled seven working days before being entitled to any benefit.

Upon the death of a member, or any of his immediate family, $25 was to be paid respectively to his nearest relatives or to himself.

Upon this liberal plan the association was conducted with but little change for upwards of nine months, and there are members who think it might have been permanently continued thus if all had stood by the association. But after the novelty of the thing wore off, there was a continual falling away in the membership, which, coupled with an unexpected draft upon the treasury for sick benefits, compelled the association to make some radical change in its rules, chiefly as follows.

The membership fee was increased to $1, members to consist of one class only. Sick benefits were reduced to $21 per month, and thirteen weeks was the limit of benefits which any member could draw in one year. The death benefit was also modified, to occur only on death of the member himself. The number of assessments was not to exceed one per month to occur at each regular pay day of the company, with power by the directors to omit any assessment when not deemed necessary, and fifty cents to be the amount per member of each assessment. An extra assessment was levied at this time to equalize the membership fee ($1), and also as the nucleus of a permanent fund which was to be increased by the surplus from any regular assessment until it should attain an amount not to exceed $100. After this limit has been reached, any surplus obtained shall go to establish a fund of like amount to be called the Benefit Fund, the object of which shall be to equalize benefits when the number receiving benefits shall be such that the amount of an assessment shall not furnish the maximum of $21 to each one. The amount to be paid in benefits in any one month under the new rules cannot exceed the amount of the assessment for that month unless drawn from the Benefit Fund, as above. In case the moneys available are insufficient to pay each one entitled to the maximum of $21 per month, the amount on hand will be equally divided among them. In no case shall a member draw benefits for the first week of sickness. From the money in the permanent fund death loans only are allowed to be paid, and this fund is not to be used for sick benefits in any case.

It is believed that the chief causes of trouble under the original rule were in attempting to pay so large a weekly benefit as $9; also in allowing benefits to be drawn for the first week of sickness, whereby quite a number of petty cases of sickness received benefits. Under the present rules while it is possible that members entitled may not

always receive the full $21 per month, such a thing is not very probable.

Since these changes were made the association has continued to prosper. Notwithstanding the difficulties encountered it has distributed among sick members in the short time since it was first organized, the sum of $570.98, or an average of nearly $2.00 per working day for the year. As no salaries are paid, and only the actual expense of management incurred, it is evident that its work has been a liberal one.

The association, now believed to be firmly established, has a permanent fund of nearly $100, and upward of sixty members on its rolls, with prospects of an increase in its members, and bids fair to permanently continue the work of assistance to those of its numbers who may be overtaken with misfortune.

Following is the list of officers chosen for the ensuing year: President, A. G. Baker; Vice-President, L. A. Bly; Treasurer, W. C. Batchelder; Secretary, G. A. Burt; Directors, J. S. Paddock, S. H. Briggs, C. H. Malmedia, H. M. Olmstead, N. E. Jewett.

(Signed) GEO. A. BURT, Sec.
New Bedford, Mass.

### Building Locomotives in Repair Shops.

*Editor American Machinist:*

In an editorial in your issue of January 19 entitled "Locomotive Building in Railroad Repair Shops," the opinion is expressed that it is not profitable for railroad companies to build their own locomotives. That, to the majority of cases where the building of locomotives in repair shops is attempted, your remarks apply correctly, there is no reason to doubt; but the increased expense of doing the work does not arise so much from the mixing of repairs and new work, as from the lax system, or rather lack of system, usually followed in the ordinary railroad repair shop. In the absence of an intelligent head of the department, who can appreciate and understand the benefit of a proper system in the repair of the locomotive as well as in its construction, work will not be conducted in the orderly and systematic manner that is essential for economy. An able head of a department must be supported by a staff of foremen who will take an interest in the work being done, or his efforts to produce work economically will fail. In a great many instances the expense of getting out work is a secondary consideration in railroad shops. This is the reason that it has not been profitable to extend the facilities of such shops, for the introduction of improved machinery would be useless where there is no intention of reducing the work to a system.

But we would infer from your article that the building and repair of a locomotive were separate and distinct operations—that a system which is applicable to the one could not be used for the other, and that when not engaged in building new work the appliances would be idle. Now let us consider the question of repairs and building in their relation one to the other. If we do so, we will find that the so-called repairs mainly consist in the renewal of the details of a part or parts of the locomotive; and again, that we are in each locomotive repairing or renewing the same parts by the same way and means day after day, as the builder has done in construction. If he has found it economical to employ special means to produce the parts in their first production, why is it not equally profitable for a railroad company to employ the same means to reproduce it? If gauges and templates have been found to expedite work and lessen the cost of production for the builder, they should be valuable in a like manner to the railroad, in that they produce the same results and are a repetition of the original. A size should be as fixed in a repair shop as in a building shop.

Locomotive builders, and all engaged in work of a recurring kind, find that a subdivision of labor decreases the cost and increases the quantity, but the system has been declared impracticable in locomotive shops, and why? In builders' shops a man is engaged on the same small job day after day, and thereby becomes surprisingly expert at his own work; and the same system runs through the whole parts of the engine. This system cannot be carried out without modification in repair shops. I am aware that it is not possible in all shops to give a man sufficient of one kind of work to keep him going; but where that cannot be done, several parts can be given him as his specialty. He becomes proficient in them, and more careful about the kind of work turned out, principally because bad work can be traced directly to him. He becomes familiar with the templates and drawings, and does not require a foreman at his elbow all the time. He will not accept bad work from another department that would be likely to bring him into trouble, nor will they, on the other hand, accept it from him. These are some of the ways that economy results from practising the subdivision of labor, and they are greatly enhanced in connection with special mechanical appliances, such as jigs and special tools. All these methods of reducing the cost of production are in operation in certain repair shops, and the system works admirably, not only in reducing the cost of each operation, but in providing the means of repairing a locomotive in much shorter time than is needed by the cut and try process. The saving effected by preventing a locomotive from being non-productive for a couple of weeks is considerable.

When this system has been by a special effort applied successfully and profitably to repair work, I fail to see why it cannot be employed advantageously in the building of new locomotives in repair shops. When a production of the parts has been done profitably, the production of the whole locomotive will be reached under similar conditions, for the whole engine is merely the sum of its parts.

There is another thing that we want considered in connection with this subject, which is that the building of new work in a repair shop has a tendency to introduce a system of finding the expense of each operation, even where no system existed before. The influence of "knowing the cost" extends beyond the new work, and exercises a good influence.

DUGALD CAMPBELL.

### Where Were the First American Tools Made?

*Editor American Machinist:*

I am anxious to know where the first iron turning lathe was made in this country; also what shop was first devoted to the making of tools? If you cannot answer the question, I would like to have it referred to your many readers, some of whom could probably give the answer. APPRENTICE.

### Examination of Stationary Engineers in Philadelphia.

Some time ago a committee of the Franklin Institute of Philadelphia was appointed to report upon the matter of having a law enacted requiring all stationary engineers and firemen of that city to be licensed. It was proposed to have five grades of licenses; the first to include those who could pass the examination, and had been continually in charge of engines and boilers ten years or more; the second, five years or more; the third, two years or more; the fourth, those found competent, without regard to time of service; and the fifth, firemen. The fees for license were to be five dollars for first grade, down to one dollar, decreasing a dollar for each grade. It was proposed that, six months after the ordinance went into effect, all stationary boilers and engines in the city should be in charge of none but licensed engineers. The majority report on this question is as follows:

*To the President and Members of the Franklin Institute:*

GENTLEMEN:

Your Committee to whom was referred the resolution, relating to the "Examining and licensing of Engineers, by a Board to be appointed by the City Authorities," presented at the meeting held October 17th, 1883, respectfully report:

It is not advisable to ask for the passage of an ordinance, requiring persons who have charge of engines to pass an examination, and be licensed by a Board. Such an ordinance would be in restraint of liberty, and should never be enacted, unless a free system is intolerable, or unless the reasons for restraint are shown to be overwhelming. Every security possible should be extended to life and property, but the undersigned are of the opinion that the proposed ordinance would not tend to increase it, for the following reasons:

*First*—The qualifications of an engineer, as sobriety, watchfulness, application to his duties, and a knowledge of the machine under his care, cannot be determined by a board of examiners, but can be, as now, by his employer.

*Second*—As the examinations must necessarily be upon the same few points, it might be possible for incompetent candidates to become possessed improperly of the correct answers to the questions, and consequently receive a license without possessing the qualifications of an engineer.

*Third*—The passage of such an ordinance would create a privileged class of men, with power to fix their own wages, regardless of the value of the service rendered; and, as proprietors would be compelled by law to employ only those having a license, it would assist in extending an odious feature of trade's unionism.

*Fourth*—Should loss of life or damage to property be caused by an exploding boiler, whilst in charge of an engineer licensed by municipal authority, it is a question whether the responsibility would not be removed from the proprietors and placed upon the city.

*Fifth*—It is not within the scope of an Institution, formed for the promotion of the Mechanic Arts, to recommend or induce legislation upon matters not relating to its purpose.

WASHINGTON JONES,
WM. HELME,
COLEMAN SELLERS, JR.,
C. M. CRESSON, M. D.

I concur in the above report except as to paragraphs Nos. 4 and 5.

THOMAS HOCKLEY.

DISCUSSION ON THE MAJORITY REPORT BY MR. JOHN W. NYSTROM.

The preamble of the majority report says that "the proposed ordinance would be a restraint on liberty, and should not be enacted unless a free system is intolerable."

All laws and ordinances are restraints on liberty, like those of the steam boiler inspection, and the examination of steamboat engineers, which have proven to be tolerable.

The five reasons given in the majority report for not examining engineers are weak and untenable.

*First reason*—That the employer is the proper person to examine his engineer is equivalent to a captain on a steamboat being the proper person to examine his engineer. Most employers would be glad to be relieved from the responsibility of examining the competency of an applicant for position as engineer. A stubborn employer, who has reached perfection in steam engineering, as is the case with one of the signers of the majority report, who can take a farmer and make an engineer of him in three hours, and who maintains that any engineer is competent, without examination, to take charge of any engine under 5,000 horse-power, should not be intrusted with authority to examine engineers, but such pretenders should be governed by wholesome laws for the security of life and property.

There is nothing in the proposed ordinance which prevents an employer from examining his engineer, nor from discharging him if not sober and watchful.

*Second reason*—"That the examination must necessarily be upon the same few points, and that an incompetent candidate may pass the examination." This assertion proves that none of the signers of the majority report has ever passed an examination as steam engineer; for, if they had, they could never endorse such an irrational statement.

*Third reason*—"That the proposed ordinance would create a privileged class who would fix their own wages, and make odious trade unions."

The locomotive engineers are not licensed, but they form trade unions and strike. The steamboat engineers are licensed, and do not form trade unions, nor do they strike. Stationary engineers have formed themselves into an association, without license of competency, and they can strike without license, and even fix their wages without license.

The Constitution of the National Association of Stationary Engineers of the United States of America says:

"This Association shall at no time be used for the furtherance of strikes, or in any way interfering between its members and their employers in regard to wages, recognizing the identity of interests between employer and employe; not countenancing any project or enterprise that will interfere with perfect harmony between them; neither shall it be used for political or religious purposes."

There has been no attempt of stationary engineers to form trade unions, nor to strike, and their different positions and wages are too varied for that purpose.

*Fourth reason*—"Should loss of life or damage to property be caused by explosions, the city might be held responsible therefor."

This is provided for by Section 12 in the proposed ordinance. The city, however, would be equally responsible for such losses by the ordinance regulating steam boiler inspection, and the United States for explosions on steamboats.

*Fifth reason*—"That it is not within the scope of the Franklin Institute to recommend legislation in matters not relating to its purpose."

The Franklin Institute bears a charter as an institution for the promotion of mechanic arts, and the examination of engineers bears directly upon that subject. Some years ago, the Franklin Institute passed a resolution to influence Congress in regard to strength of steam boilers, which was proper; but at another time it passed a resolution to influence Congress to establish a colony near the North Pole, which had nothing to do with the promotion of mechanic arts. The fact is, that the Franklin Institute is the most proper body of authority for recommending the proposed ordinance to the City Councils for its passage.

The passage and enforcement of the proposed ordinance would soon create a very intelligent and reliable class of stationary engineers in Philadelphia, of whom steam users would reap the greatest benefit. The waste of fuel, wear and tear of engines and boilers, and risk of steam boiler explosions are generally very great when in charge of incompetent attendants, examples of which are frequently published in periodicals, particularly in the *Locomotive*.

One of the most eminent members of the Franklin Institute believes that the passage of the proposed ordinance would enable a schoolboy to pass the examination as engineer!

Those who oppose the passage of the ordinance for examining engineers, naturally do so because they cannot see the utility of it.

It has been stated to the Chairman of this Committee by three or four eminent members of the Franklin Institute, each one being a steam user, that, "I have the most competent and reliable engineer that can be found in Philadelphia, but he cannot pass an examination;" and that he (the steam user) "cannot afford to lose such a good man by the passage of the proposed ordinance."

It is provided by section 7, in the proposed ordinance, that such a good engineer may receive a certificate without examination, and we can expect that the examiners will be men of sound judgment who would not refuse a certificate to a competent man.

A "felt want" in mechanical practice is the means of finishing a tap after it has been hardened. Many attempts have been made to perform this feat, but thus far without success. Reflection on this mechanical problem at once suggests the employment of the diamond as a cutting tool, but experiment seems to indicate that success does not lie in that direction. The Pratt & Whitney Co. experimented a good deal with the diamond for cutting hardened thread gauges, but it did not answer. The diamond could be made to scratch, but when an attempt was made to produce a distinct cut it was a failure. Any one who can hit upon a method of cutting hardened taps will strike something that has "millions in it," and he will perform a real service on behalf of exact mechanical work, and it would be useful in many operations. We offer this suggestion to the inventive talent of the country. If it diverts attention for a day from the rotary engine and car coupler our object will be accomplished.

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NEW YORK, FEBRUARY 9, 1884.

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## Franklin Institute on Examinations for Stationary Engineers.

The report of a committee, which was appointed by the Franklin Institute of Philadelphia a short time ago, to inquire into the necessity for requiring stationary engineers to pass an examination before being permitted to take charge of steam boilers, is published in another column. We confess that the line of argument adopted in the report surprises us. It may be, that the men in charge of steam boilers in Philadelphia perform their duties so satisfactorily that there is no necessity for disturbing existing arrangements; but that is no reason why the influence of the Franklin Institute should be given in favor of a report, whose arguments apply against restrictions being placed on any class of men freely following any calling, whether they be competent or not. If an ordinance to prevent men from taking charge of boilers till they are declared qualified for the position would be in restraint of liberty, and is therefore considered intolerable by the Franklin Institute, we cannot see how that eminent society can consistently endorse the laws which require a man to obtain a diploma from a medical school before he shall be permitted to practice as a physician. The practice of "licensing" a doctor creates a privileged class, a consummation which seems to be greatly dreaded by the committee of the Franklin Institute; but the public good is promoted by the practice although it may savor of what the report calls, "an odious feature of trades unionism."

The movement towards requiring men to prove themselves competent before being put in charge of steam boilers, originates from the desire to grapple with an evil which is a continual source of danger to the people. If steam users could be trusted to employ only competent attendants to their boilers, there would be no necessity for the law infringing their personal liberty so far as to say who shall *not* be left in charge; but unfortunately many steam users are extremely reckless in this matter, as numerous fatal explosions have testified. If boiler owners were likely to be the only sufferers from an explosion, it would be a hard matter to get laws passed that would prevent them from committing accidental suicide; but under the existing state of matters, the owner of the boiler generally escapes while disinterested parties become the victims. To prevent this, public safety demands that wise men shall incur some inconvenience, so that their foolish brethren may be prevented from destroying the lives and property of their fellow men. It is a matter of profound regret that the influence of the Franklin Institute should seem to be arrayed on the wrong side of this question.

The practice of employes, in any manufactory, of mortgaging their wages before payday, is a bad one and should be discouraged. The proprietors of the Blackstone (Mass.) Cotton Mills have given notice that no one will be employed who assigns his or her wages, and all assignments now running must cease by the first of next April. They pay their employes once in two weeks. If possible, shop, mill, and factory proprietors should pay wages every week and take decided measures to prevent assignments.

## Literary Notes.

THE COMPLETE CARRIAGE AND WAGON PAINTER. A Concise Compendium of the Art of Painting Carriages, Wagons and Sleighs. Embracing full directions in all the various Branches, including Lettering, Scrolling, Ornamenting, Striping, Varnishing and Coloring. With Numerous Receipts for Mixing Colors. Illustrated. By Fritz Schriber. New York: M. T. Richardson. Price $1.

This book has been written for the purpose of giving a comprehensive treatise on the methods employed by experienced workmen in the ordinary run of their business of painting. The author has succeeded in producing a work which is plain and practical, and cannot fail to be of service to the young painter or apprentice seeking for extended information on the best shop methods. This throws open secrets of the trade which are embraced in the mental range of experienced workmen, but generally remain a mystery to those who are beginning to tread the thorny road of searching for knowledge in the workshop. It is one of the line of books that makes the way of the ambitious apprentice easier. We commend the "Complete Carriage and Wagon Painter" as a rich fund of information for those interested in the subjects relating to that department of painting.

We observe that our enterprising contemporary, the *Railway Review*, of Chicago, has arranged to publish during the year a series of articles written specially for the *Review*, by some of the best qualified railroad managers, civil engineers, &c., in the country. Among the men announced as contributors are Charles Francis Adams, Geo. R. Blanchard, Octave Chanute, C. E.; D. J. Whittemore, C. E.; William P. Shinn, and others of equal ability. Articles containing the views of these experienced men on railroad topics cannot fail to excite wide-spread interest. The *Review* is a live, go-ahead paper, full of newsy practical matter, and well posted on all the living subjects exciting interest among railroad men.

The editorial matter is prepared in such a way that the paper is equally welcome to the railroad manager, the master mechanic, and the purchasing agent; and we know it is a welcome visitor among a wide circle of these classes, who take the *Review* because its pages are interesting as well as instructive.

## QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.*

(43) J. W., Moline, Ill., asks: Of what value is a process for hardening copper so that it will cut steel? *A.*—We do not see that it would be of any particular value.

(44) J. F. C., York, Pa., asks: Can you give me a rule to set the head of a planer to plane a given taper? *A.*—None, except to measure the amount you set over, per inch or foot.

(45) Apprentice, Boston, Mass., writes: I would like you to tell me the proper way to speed a governor, and to calculate the speed of pulleys? *A.*—See answer to Question 120, March 31, 1883.

(46) D. N. D., Newark, N. J., asks: Please give me the horse-power of an engine 21/2"x31/2", at 300 revolutions per minute; boiler pressure, 100 lbs.? *A.*—Such an engine, if well constructed, should develop one horse-power.

(47) R. V., Grand Rapids, Mich., asks: 1. Will you give me the composition of the best babbitt metal? *A.*—Babbitt metal takes its name from the inventor, and there is but one kind, the composition of which you will find given, in answer to a question, in the AMERICAN MACHINIST of April 21, 1883. 2. Has the American Smelting Works a preparation of their own for lining metal not known to parties outside? *A.*—We have no doubt that they have.

(48) M. Z., New York, asks: If the foreman of a factory, who is himself an engineer, puts a man in charge of an engine and boiler, he giving them no attention, should that man pass an examination as an engineer, and if examined can he be arrested for not having been examined before? *A.*—The law in this matter is very feebly enforced in this city. The man should be examined as an engineer. He will not be likely to be arrested for not having been sooner examined.

(49) J. S. P., Baton Rouge, La., asks: Is the brand on boiler plate intended to designate its full strength or safe working pressure? I know of instances where boilers 42" diameter, made of 1/4" plate stamped 55,000 T. S., are carrying 110, even 120, lbs pressure. Now, as 110 lbs. on such a boiler gives 58,080 lbs. tensile strain, I am at a loss to know what the stamp "55,000 lbs. T. S." means? *A.*—The stamp indicates the ultimate tensile strength of the plate per square inch of section. In the boiler to which you refer there would be a pressure of 42×110=4620 lbs., which must be held by two thicknesses of iron, one on each side. The combined thickness of the plate being 1/4", the tensile strain to which the iron is subjected is 4620×2=9240 lbs. per square inch of section.

(50) Machinist, Boston, Mass., asks: Do you think it possible to run cast-iron ring packing in a steam-engine cylinder at a speed of 3,000 feet per minute, and have it last any length of time? *A.*—We see no reason why it should not last for about the same number of feet total travel, whether it is run 3,000 or 300 feet per minute.

(51) J. W. M., Walden, N. Y., writes: I wish to experiment with a small steam engine 6"x12" Will you give me proportions of valve and seat to cut-off, with a lap valve, at 1/2 and 3/4 stroke? *A.*—You do not state at what speed you propose to run your engine. Assuming you want to run at moderately high speed, you can make steam ports 1/2"x5"; bridges, 3/8"; exhaust cavity in seat, 1 5/4"; travel of valve, 2 3/8"; outside lap of valve, to cut off at half stroke, 1"; to cut off at 3/4 stroke, 13-16". No inside lap to valve.

(52) W. M., Bloomington, Ill., writes: Can you give me the names of two or three technical schools where a machinist can go through a course of one or two years' study? *A.*—Ohio State University, Columbus, Ohio; Stevens Institute of Technology, Hoboken, N. J.; Worcester Free Institute of Industrial Science, Worcester, Mass.; Massachusetts Institute of Technology, Boston, Mass. By writing to either of these institutions, you can get all the information you desire.

(53) J. A. B., Canada, asks: What is the proper length of run for a boiler carrying 80 lbs. steam? I mean the entire distance traversed by the hot gases from the time they leave the grate till they enter the chimney. *A.*—This is a matter depending upon the intensity of draft, and other circumstances. For multi-tubular boilers the length of tubes (which govern the run) is usually proportioned somewhat by the diameter of the tubes, and but little by the steam pressure. A length of 14 to 16 feet for a 3 1/2" tube is found to give good results.

(54) W. C., Columbus, Ga., asks: How fast should a grindstone for grinding tools be run? *A.*—Grindstones for grinding tools are run at speeds varying from 200 to 350 feet peripheral speed per minute. About 250 feet is a fair average. A good way to come at the speed is to mount the stone and turn it by hand until a speed is attained at which the water will fly off, so as to begin to be troublesome. The speed at which it is run should be a little less than this.

(55) W. K. H., Lawrence, Kansas, writes: We have here a hill 160 ft. in height. If we take water from the top of the hill through 1,500 or 2,000 feet of 12" pipe, there being 160 feet difference in height in the inlet and outlet ends of pipe, what will be the pressure of water at the lower end? *A.*—The pressure of water due to a head of 160 feet is 160+2.3=69.5 lbs. per square inch. What the pressure will be with the water flowing freely out of the pipe will depend upon a great variety of conditions and can only be estimated by a careful consideration, and from a complete knowledge of all the circumstances.

(56) C. A. W., Grand Rapids, Mich., writes: In your issue of January 12, in answer to Question 21, you state that the entire surface of the boiler is used in finding the total pressure. In Forney's catechism of the locomotive, page 85, there is quite an elaborate article to show that the diameter should be used. Which is right? *A.*—There is no contradiction, as you seem to infer. It is evident that the total pressure must be the number of square inches exposed to pressure multiplied by the pressure per square inch, and just as evident, as Mr. Forney says, that "only a portion of the pressure on the inside surface of the boiler exerts a pressure to burst the sheet at any one point."

(57) T. W., Penn Yan, N. Y., sends sketches of three slide valves, and asks: Which is the best one to use? *A.*—The valves appear to be alike, with the exception of the exhaust lap. The steam ports appear to be 1/8" and the steam lap 3/8". In No. 1 the exhaust lap is 1-16"; in No. 2 it is 0; and in No. 3 there is inside clearance of 1-16". Under certain conditions, either of the three might be best; but, assuming that the valve has travel sufficient to fully, or very nearly, open the port for admission, and that the clearance is about as usual in small engines, we should prefer No. 1.

(58) A. E. E., Mt. Pleasant, Mich., asks: 1. Is a young man, twenty years old, too old to learn the machinist's trade? *A.*—No. 2. What book of mathematics would you advise an apprentice to the above-named trade to study, he having a good knowledge of arithmetic and a fair knowledge of algebra? *A.*—Geometry. 3. What will be the probable time required by a young fellow who likes things mechanical, and who would get right down to business, to learn the machinist's trade? *A.*—Three, and sometimes four, years are served by apprentices to this trade. In that time they can, if they try hard, learn considerable of the elements of the trade. They will never get through the learning process. 4. How long does it take to learn iron or brass moulding? *A.* The same as to learn the machinist's trade. 5. What is the length of connecting rod on a well-proportioned engine? *A.*—That depends upon circumstances, such as the use the engine is put to and the kind of engine. Horizontal stationary engines usually have connecting rods from five to six cranks in length; that is, from 2 1/2 to three times the stroke.

(59) S. W. K., Franklin, Pa., asks: Will you tell me of some way to clean the scale from old boiler tubes after they have been removed from the boiler—I mean some way easier than by the use of files? *A.*—In railroad shops old tubes are sometimes cleaned by rolling them in a tumbler, something as small castings are cleaned. There are also one or two special machines made and sold for cleaning tubes. The old-time way of cleaning tubes was to drive the shanks of two half-round files into a block, so that the files should cross each other like the letter **X**, and draw and shove the tube back and forth in the upper part of the cross.

(60) J. D. W., Waukon, Ia., writes: I have a steam engine 5″x5″. The throw of eccentric is 1⅛″; the exhaust port is 1″x2⅞″; the admission port, ½″x2⅞″; bridges, ¾″; valve, 3¼″ long with exhaust cavity, 1⅝″x2⅞″. I wish to put on false seat, and make a new valve. I have 5¾″ room in steam chest for valve, and want to get a better proportioned valve motion. How can I do it? *A.*—If the ports could be lengthened to 5″ and the travel increased ⅛″, or even with the travel as it is, it would be an improvement. Probably you cannot lengthen the ports, in which case you will get a smarter valve motion by increasing the outside lap of valve to 7-16″ (making the total length of valve 3⅝)″, and increasing the travel of valve to 1¾″. This supposes the ports, bridges and cavity in valve to be left as they are.

(61) H. H. L., New York, writes: A certain machine, which is to run 300 revolutions per minute, is driven direct from line shaft, which runs 100 revolutions; diameters of pulleys, 12″ and 36″. This naturally strains the belt considerably, and requires considerable power. Could not the difficulty be overcome by putting in two intermediate shafts, so as to increase the speed gradually, and require less power? *A.*—All the power that reaches the machine must, in either case, be taken from the main shaft. By the means you speak of, you will get pulleys nearer of a size, and hence gain a little in that way, but you will have the additional friction of the two intermediate shafts to offset any gain you may make. The correct remedy is to use a wider belt, belting just as you do now.


## BUSINESS SPECIALS

*Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*

Models & Mach'y—G. D. Lambert, New Haven, Ct.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

Spanish translations of catalogues, circulars, &c. J. M. Da Rosa, 260 East 3d St., Cincinnati, O.

Wanted—Brown & Sharpe large Universal Milling Machine. W. E. Lewis, Corry, Pa.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh, Wells, & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

Wanted—A 50-inch planer, 48-inch engine lathe, 60-inch engine lathe, second-hand, in good order. Address, Box 879, New York City.

H. O. Reinhardt, M. E., Mem. Am. Soc. Mining Eng., Chihuahua, Mex., invites correspondence of man'f'rs of machinery desiring to introduce same in Mexico.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

"Catechism of the Locomotive."

The most complete and easily understood treatise on the locomotive; 625 pages, 250 illustrations. $2.50. For sale by "The Railroad Gazette," 73 Broadway, New York.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880. A limited number for sale at $3.50 per volume, express charges to be paid by purchaser. $4.50 per volume will be charged for 1881 and 1882. AMERICAN MACH. Pub. Co., 96 Fulton st., New York.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

EXTRACTS FROM CHORDAL'S LETTERS, containing nearly 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with additional illustrations, many of them humorous and all effective: over 50 in all. Just the thing for a holiday or birthday gift. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Useful Information for Steam Users—A 100-page pamphlet, compiled from the best authorities, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, N.Y.

Patent "Common Sense" Binder for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.


## MANUFACTURES.

Jake Galtman, of Aberdeen, Miss., is raising money for a cotton factory.

An iron foundry is to be built at Easton, Pa., by W. Rewalt, of Philadelphia.

Henry Jeffrey & Co. have bought a machine shop, with all its belongings, in Woonsocket, R. I.

Addison Vance, Winston, N. C., proposes to open a new machine shop in that town.

The Wilder Machine Works, Chattanooga, Tenn., will erect a new factory on the west side of the town.

Plans for the Waco (Texas) Woolen Mill have been accepted. The main building will be 305x64 feet.

The Ellithorpe Air Cushion and Air Brake Company, Chicago, Ill., started their new works on the first of the month.

Joseph H. Smith & Son, of Athens, Tenn., have bought out the Athens Foundry and Machine Works, and propose to add new machinery.

The new machinery has been placed in the Marine Engine Works, 52-56 Illinois Street, Chicago, and the works started.

The Tricycle Manufacturing Company, Springfield, O., will build an addition, 150x40 feet, three stories high, thus increasing capacity one-third.

The Dearborn Foundry Company began operations January 1 at 1,525 Dearborn Street, Chicago. They make mostly architectural and machine castings.

Ground for the $200,000 cotton factory at Dalton, Ga., has been purchased by Wiley Patton. It is understood that the money has been secured, and the company will be incorporated.

The Baltimore *Manufacturers' Gazette* says: "Prospects seem to be improving for a cotton factory in Columbus, Miss., John D. Morgan, of that city, having started the subscription list for capital.

Fall River, Mass., is to have another cotton mill built in the southern part of the city. Jas. Cunneen has been active in getting subscriptions, and the stock is now all taken.

The H. L. Shaffer Foundry Company, Pittsburgh, Pa., is a new organization that has obtained control of the old foundry of the Pittsburgh Smelting and Tuyere Company.

The Kilbourne & Jacobs Manufacturing Company, of Columbus, Ohio, will make an early extension of its works by building additions to its machine and blacksmith shops. It is employing 200 men.

E. P. Bullard, 14 Dey Street, New York, proprietor of the Bridgeport Tool Works, has sold forty-three Bridgeport lathes to one party this year. Near the close of last year the same party bought thirteen of the same kind of lathes.

The Tapley Machine Company, of Boston, with a capital of $100,000, has been incorporated for the manufacture, sale, and leasing of tools and machinery, under the Tapley patents. Augustus P. Martin, president; Theodore A. Dodge, treasurer.

The Pusey & Jones Company, of Wilmington, Del., has closed with parties in Brazil contracts for building four iron side-wheel river steamers, each 160 feet in length. Work on the boats will be commenced at once, and completed during the present year.

The H. B. Smith Company, of Westfield, Mass., has begun laying the foundation of its new works on the north side of the river, and expects to have the buildings ready for use by spring. It employs 150 workmen, and is much cramped for room in its present quarters.

J. M. De Rosa, of Cincinnati, O., is now engaged in translating into the Spanish language the catalogue, circular and price list of Lodge, Barker & Co.'s machinery, with the view of introducing their trade in countries where the Spanish language is spoken.

Benj. Eastwood, Paterson, N. J., has recently opened warerooms at 40 Cortlandt St., New York, for pulleys and hangers and new steam laundry machinery. He built a new shop last year, and has ninety men at work. He has built silk machinery for a number of years.

Clarksville has appointed a committee to visit Cincinnati and consider the proposition to move the Malleable Iron Works, now being operated in the latter city, to Clarksville. The proposition is, substantially, that Clarksville contribute $37,500 for a half interest in the new enterprise to be established there, to which the company will add its plant, valued at $49,235.—*Ashland (Ky) Independent.*

The Baltimore and Ohio Railroad Company have purchased the Buckeye Car Works, situated in the eastern part of Columbus, O., and will take possession about the 1st of March. The railroad company has long needed works of this kind, having none west of the Ohio River. As soon as the company takes possession, about 300 men will be employed in the building of cars.

An incorporation of the Union Iron Works, of San Francisco, has been perfected, and extensive premises are being built on the water front in South San Francisco. It is said that $500,000 have been spent and $1,000,000 additional will be disbursed in building and machinery. A hydraulic dock forms part of the scheme of operations. Iron and steel ships will be constructed, and every kind of machinery turned out.

James Jenks & Co., manufacturers of the Duplex Injector, Detroit, Mich., write us: "The last year's business was satisfactory, and prospects for 1884 are very flatter'ng. We have added special tools for special purposes, and are making our work much more satisfactory to ourselves. We are just bringing out three new injectors, and we look forward to large increase of trade the coming year."

Moffett & Gregg, Rushville, Ind., write us: "The business outlook in piping, pumps and pump fitting starts out very encouraging. If we do two-thirds the business this coming year (as the presidential contest will be upon us), we will consider ourselves doing excellent. Those who have repairing to do seem to be anxious to have it done. Money matters seem to be easier."

The Innes Manufacturing Company, Oil City, Pa., write us: "We notice in your industrial items you frequently mention extraordinary outputs of different works. We think we are entitled to the cake for outputs of steam engines, as during twenty-five working days in December, 1883, we made and shipped just 100 of our 9x12 artesian well engines. They weigh about 3,250 lbs. each, and there is no better one made for the purpose.

C. A. Seley, Consulting Engineer, St. Paul, Minn., writes us: "The fire which destroyed the Drake Block, on December 13th, cleaned out my entire stock of instruments, books, drawings and records, making a new start necessary. Have obtained a part of the 'necessaries,' and can be found at the address above. This section of the country looks forward to a year of even greater building and improvements in all lines than was enjoyed last year."

I. B. Davis & Son, manufacturers of the Berryman Feed-water Heater and the Economic Steam Pump, Hartford, Conn., write us: "We find, upon figuring up, that the sales for the year fall short of 1882 quite a good deal; but comparing them with the years previous to 1882, they are fully up to the average. The greatest falling off seems to have been from November 1 to the end of the year. We look for good business the coming year, as inquirers are quite numerous, and it looks as if business was picking up."

The Deane Steam Pump Company, Holyoke, Mass., have fitted up the necessary pumping apparatus for the water-works of nine cities within the past few months, costing from $4,000 to $16,000 each. They are at work on five more of these pumps and engines, and three large pumps, one of which is of 28-inch diameter, are ready for export. The company are running their works on full time, and they employ about 225 men in the different departments. The past year has been a prosperous one with the company, the business having been in excess of any former season.

The Korting induction condenser for steam engines has recently been furnished to the following parties: George West, Ballston, New York; United States Illuminating Co., New York; Stanley Felt Mills, Stanley, New Jersey; Seneca Lake Navigation Co., Geneva, N. Y.; Sanford Mills, Sanford, Maine; J. N. Pratt, Portland, Maine; Portsmouth Machine Co., Portsmouth, N. H.; Small, Gould & Co., Baldwinsville, Mass.; E. L. Robbins, Honolulu, H. I.; M. P. Robinson, Honolulu, H. I.

The Wharton Railroad Switch Company, Philadelphia, have purchased the Wootten locomotive patents, and are now handling the engine. They are prepared to furnish estimates for locomotives of every class by any of the best builders, or they will sell royalties embodying the Wootten principles, to be built under their inspection from drawings furnished by them. These locomotives render such a good account of the fuel consumed that we expect to see many of them built under this new departure.

The Kensington Engine Works, Limited, Philadelphia, Pa., write us: "Our business for 1883 has been much greater than for the previous year, and our shop ran on full time continuously; and, while we have not so many orders ahead, still the outlook is promising. Having received additional privileges from the Buckeye Engine Company, of Salem, O., we have purchased a property adjoining, and expect to increase our works this year, providing tools and facilities for the manufacture of our engine of all sizes."

The Consolidated Safety Valve Company, 111 Liberty Street, New York, write us: "Our business in 1883 was 25 per cent. larger than in 1882, and mostly for a class of what may be termed high-priced goods, when compared with those of some other manufacturers. The value of our solid nickel seat for safety valves is becoming more fully appreciated every year, as engineers and steam users learn of its merits. For our locomotive valves our trade has always been large, as the Richardson pop valve has been favorably known to railroad men for the last fifteen years. We are adding a number of special styles of valves to our business, and from present indications our business for 1884 will warrant us in the efforts we are making to supply the increased demand."

The Christiana (Pa.) Machine Company write us: "Our business for the past year has been quite good, enabling us to run full force on full time, but we were unfortunate in having our machine and pattern shops burned on October 1st (just in our busiest season), entailing a heavy loss, especially on patterns, the bulk of which were in this building and entirely consumed. Most of our machinery in machinery shop was saved in fair condition by flooding it with water. This saved us much valuable time, and with a force of fifty men we rebuilt, and were in operation, in a little less than a month, and are now well fixed again and have much larger and better shops than before. We hope the present year will be a good one for all, but we confess to some fears in the matter."

Hetherington & Berner (Founders and Machinists), Indianapolis, Ind., write us: "Business with us has been very good the last year. We have just added to our works a new boiler shop, 50x100 feet, equipped with the best machinery, and in the spring will make a large addition to our machine shop. Our specialties are architectural iron-work and vertical engines. We also manufacture the Lowrey & Crawford hog-scraping machine that does the work of sixty men. Business for the next year, we think, will not be as good. There is a kind of distrust and uncertainty—there are so many harping about free-trade. We passed through one era of free-trade once, and we don't want any more of it. Should we not rather make our own people rich by protection than make the English rich by free-trade, at the expense of our own industries?"

John Beezley, Keokuk, Iowa, writes us, giving some manufacturing items, which show that Keokuk has had a business boom during last year. Plow works, the largest in the State, have been started, and are now running all departments, except the foundry, which will be commenced about the first of March. They employ about 150 machinists. Cutlery works have been put in operation, and they are turning out thirty gross of knives and forks a day, and running about forty hands. The Malleable Iron Works are doing a big business in the Wood steam plows and general machine work. The Adams Fence Company and the Rickards Fence Factory are both doing a big business. These are all enterprises of 1883, and their prosperity is helping the town immensely, so that other lines of business are prospering. A new street railroad has been built, and commenced running on the first day of the year.

The Buckeye Engine Company, Salem, O., write us: "Our business for 1883 has been quite satisfactory, averaging about 200 hands, running a portion of the time nights, and now running ten hours per day only. Wages are about the same as in 1882. We have added a number of new tools and other appliances, as well as lighting every department of our works with electric lights during the year, materially increasing our capacity for additional work, and filling orders more promptly. The present outlook for 1884 does not look so flattering as it did one year ago for 1883, especially in the iron districts. The feverishness among the iron men, anticipating Congress meddling with the tariff question, and the fact that the business of the country will be more or less disturbed in the coming presidential election, will have its effect in certain localities directly, as well as throwing a wet blanket over the general business of the country. Notwithstanding these obstacles, there are other indications that promise a fair and healthy business for 1884. We have no reason to complain of our foreign trade; indications for 1884 are fair for an increase of orders from that source."

The Asheroft Manufacturing Company, 111 Liberty Street, New York, write us: "During 1883 our business largely increased in all departments. We added some $10,000 worth of new tools to our plant, and new articles of manufacture in our line, notably one—the Moscrop Continuous Recorder—for giving a continuous and accurate record of the turning of engines in all lines of manufacture. We have been unable as yet to fill our orders for these instruments. Our business in the indicator showed a very marked increase of sales, and from the reports we have received from those who have used the Tabor indicator, we feel warranted in saying that the great expense we have been to in endeavoring to make this instrument the best of its class is being appreciated. The increase in orders in our steam gauge department for the better class of steam instruments encourages us in sticking to our policy of making everything in that department first-class, and getting fair prices for it, instead of going in indiscriminately to compete for a class of trade that is governed entirely by price, and the growing intelligence among steam users satisfies us that there is a class of this trade to be catered for which it is a satisfaction to make goods to supply, as they are appreciated. We have just added a new steam trap to our line of goods—simple, effective and cheap."

The National Safety and Lock Company, of Cleveland, O., has been incorporated, with $250,000 capital. They propose to build a shop to employ 300 or 400 men. Incorporators are H. R Hatch, E. W. Bell, P. M. Spencer, W. K. Miller, C. G. Barger, James White, John N. Ramsey, Howard White and Thos. Simmons.

The Allen Portable Pneumatic Riveting and Machine Company, 204 Broadway, New York, write us: "We have shipped this week one of our new-style riveting machines, with 34½ inches reach, to the Dominion Bridge Company, Lachine, Canada, and have two orders for similar machines to go to Pittsburgh. These machines are perfectly balanced, capable of operating in any position, and are very easy to handle. They are likewise arranged capable of being fixed to a foundation to work as a stationary machine. Business is very good."

## Machinists' Supplies and Iron.

NEW YORK, January 24, 1884.

There are no notable changes in the supply or machinery business. The Indianapolis Machine and Bolt Company, the John T. Noye Manufacturing Company, of Buffalo, and the Falls Rivet Company, of Cuyahoga Falls, Ohio, have issued a circular describing the Fulton pulley they propose to manufacture. This pulley is made up of a corrugated steel disk with ears, to which a steel rim is bolted. The hub, in two pieces, of malleable iron, is also bolted to the steel disk. As a warning to those who may feel disposed to evade the claim by which they hold the right to control this invention, they say: "It may be well, in closing this sketch, to call the reader's attention to the fact that the Fulton pulley is plastered thick with patents. Indeed, it would surprise many to know how thoroughly the work of the patent lawyers has been done in this case." The manufacturers of brass have formed an association, and published a revised price list.

In iron the demand is still principally for small lots, prices remaining about the same as at the commencement of the year. We quote—No. 1 X Foundry, $20 to $21; No. 2 X, $19 to $19.50; Gray Forge, $16.50 to $17 50.

In Scotch pig there is some business in lots to arrive, but in lots in store there are very few transactions.

Antimony is in moderate demand, but is held firm, at—Hallett's, 10¾c.; Cookson's, 12c.

Copper—Lake, 14¾c. to 15c.; other brands, 14c. to 14½c.

Lead is quiet, at 4.25c. to 4.30c. for jobbing lots.

Spelter—Refined, 8c. to 8¼c.

Tin—Banca, 20c. to 20½c.; Straits and Malacca, 18½c. to 18¾c.

## WANTED

*"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.*

A mechanical draughtsman wants situation. Good references. Address, E. D., AM MACHINIST.

Wanted—A situation by a young married machinist of fifteen years' experience at the trade Would like to settle down in some small town or city. Address, Henry, Auburn, N. Y.

Wanted—Situation in a machine-shop office, by one accustomed to all details, as practical machinist, draughtsman and book-keeper. Address, Machinist Book-keeper, care AMERICAN MACHINIST.

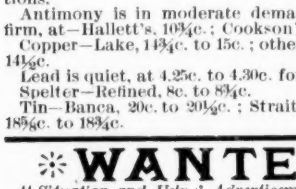
Wanted—A situation by a competent machinist, who is also a good draughtsman, has had experience as foreman, and in building file cutting machinery. Address—P. O. Box 577, Beaver Falls, Pa.

Wanted—A shafting turner. Wanted, a man who has made the turning of shafting a specialty for a long time. State experience, references and wages expected. None but experts need apply. Address, Medart Patent Pulley Co., St. Louis, Mo.

Wanted—A good second-hand planer; size, about 42"x42"x10 feet. Must be in good order and ready for immediate delivery. Send particulars, giving size, condition, maker, where it can be seen, with lowest net price, to Box 7, AMERICAN MACHINIST.

Tools Wanted—One good strong engine lathe, 36" swing, 10 feet between centers, that will cut heavy screws and for boring cylinders, etc.; also one Helve hammer, to work up to 6" iron; to sell, one 200 lb. Ferris & Miles steam hammer, in good order; to sell, one 2" hand bolt and pipe threading machine. Geo. R. Lombard & Co., Augusta, Ga.


HILL, CLARKE & CO.
36 OLIVER STREET,
Boston, Mass.
BRANCH OFFICE, 800 N. 2nd STREET,
St. Louis Mo.
Have just issued new
CATALOGUE
—OF—
LIGHT MACHINERY & SMALL TOOLS.
Sent free to Manufacturers and Dealers on receipt of their business card.



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FLUE HOLE CUTTERS.
With Renewable Cutters. Kept sharp by grinding on end.
MYERS MFG. CO., CHICAGO, ILL.

Engine Lathes, Hand Lathes,
SLIDE RESTS and PLANER CENTERS.

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6 Smaller Drills—new and second-hand,
24", 26", 32" Planers,
Small Pratt & Whitney Shaper,
Eccentric Chuck, Standard Mandrels,
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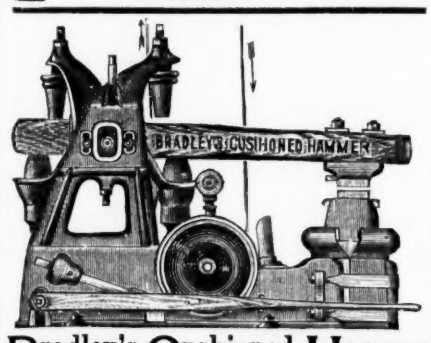
A. G. BROOKS,
26 N. 3d St., Philadelphia, Pa.

ELEVATORS FOR MILLS.
Send for Catalogue to
Cohoes Iron Foundry & Machine Co.
COHOES, N. Y.

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Stands to-day WITHOUT AN EQUAL.
OVER 800 IN USE.
BRADLEY & CO., Syracuse, N. Y.
ESTABLISHED IN 1832.

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Compiled principally for Students, but also of great value to all Mechanical Engineers. By HENRY ADAMS. 93 pages, 12mo, $1. Descriptive Catalogue (100 pages) free.
E. & F. N. SPON, 35 Murray St., N. Y.

WATER.
CITIES, TOWNS AND MANUFACTORIES
SUPPLIED BY GREEN AND SHAW
Patent Tube and Gang Well System,
WM. D. ANDREWS & BRO., 233 B'way, N.Y.
Infringers of above Patents will be prosecuted.

COOKE & CO., DEALERS IN
Machinery and Supplies,
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AGENTS FOR

The Waters
Perfect Governor.
Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

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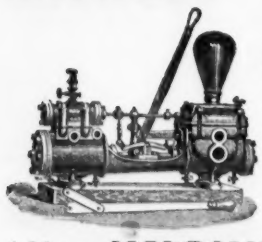
THE STANDARD!
THE BEST MADE PUMP! THE BEST PUMP MADE!



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Air Pumps and Condensers for Steam Engines a specialty. Will save from 20 to 30 per cent. fuel.
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Address KNOWLES STEAM PUMP WORKS
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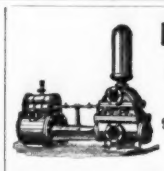

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92 & 94 Liberty St. NEW YORK. | 54 Oliver St. BOSTON | 49 N. 7th St. PHILA. | 226 & 228 Lake St. CHICAGO. | 620 & 622 N. Main St. ST. LOUIS.
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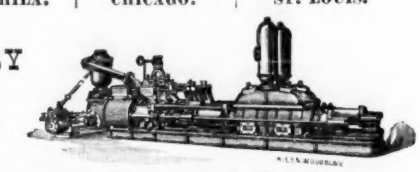
FOR EVERY POSSIBLE DUTY.
Independent Condensing Apparatus
A SPECIALTY.



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Emery, Quartz, Corundum, Wooden Polishing Wheels, Automatic Knife Grinding Machines.
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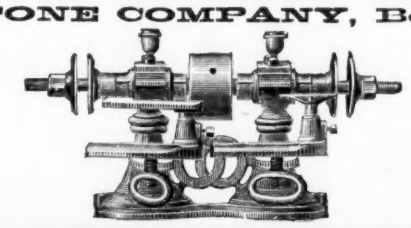

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Is the Standard of Excellence
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THE HERCULES TURBINE
Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.
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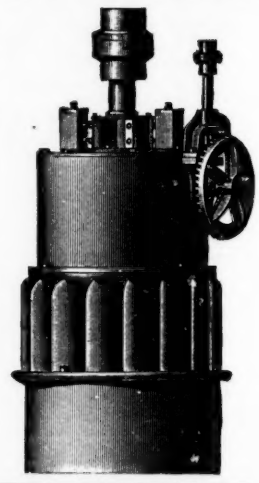
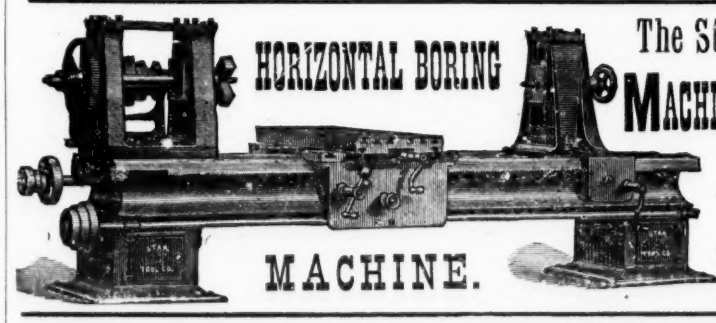
Send for Catalogue, Circulars and Price List to either of the above places.



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Manufacturers of Oil Cups for Locomotive, Marine and Stationary Engine Cylinders, under the Siebert and Oates patents, with Sight Feed.
TAKE NOTICE.

The Sight Feed is owned exclusively by this company. See Judge Lowell's decision in the United States Circuit Court, District of Massachusetts, Feb. 23, 1882. All parties, except those duly licensed by us, are hereby notified to desist the use, manufacture or sale of Infringing Cups, as we shall vigorously pursue all infringers.
The Seibert Cylinder Oil Cup Co., 53 Oliver St., Boston, Mass.

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THE NEW SOMBART PATENT Gas Engine
Best motor for small powers ¼ to 1 *actual* horse power. Send for prices. SOMBART GAS ENGINE CO., Hartford, Conn. New York Office, 215 Centre St.

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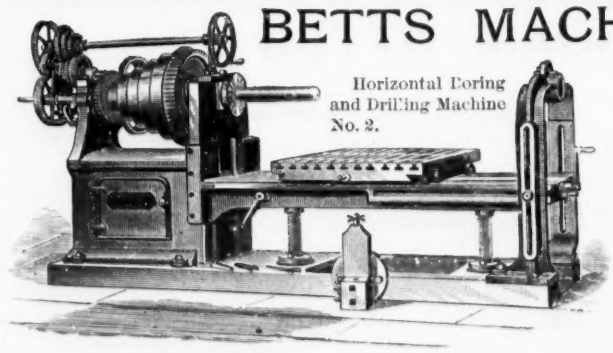

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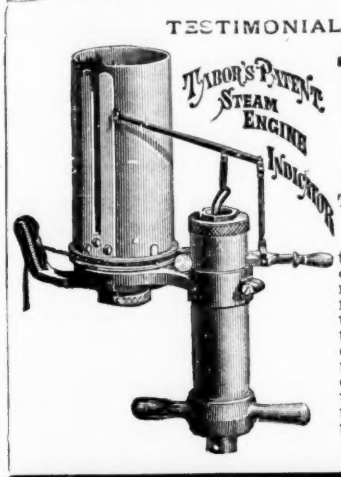



# TABOR INDICATOR.

ARMINGTON & SIMS ENGINE CO,
PROVIDENCE, R. I., Dec. 28th, 1883.

THE ASHCROFT MFG. CO.,
111 Liberty Street, New York.

*Gentlemen:* Your letter received. Our experience with the Tabor indicator has been satisfactory. We ordered one of your first Indicators to test our 12x12 engine, running 350 revolutions per minute. This was the first engine we built for Mr. Edison, and was sent to the Paris Electrical Exhibition with his large dynamo. We used every Indicator attainable at that time, but all save yours failed to do the engine full justice. To the exact and excellent testing of the Tabor, therefore, is our commercial success in a measure due. We have built 125 engines for Mr. Edison, nearly all of which have been tested by your Indicator. We now have three Tabor Indicators, and you have our order for one pair to be sent to England.—Yours truly.

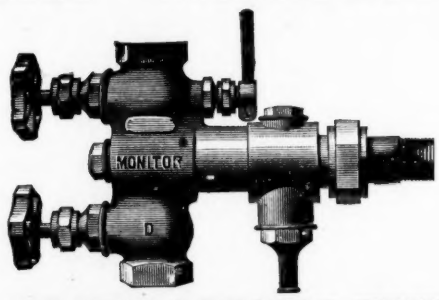
GARDINER C. SIMS, SUPT.

# MILLING MACHINES.

Universal, Manufacturing and Special.

C. E. LIPE, SYRACUSE, N.Y

# THE "MONITOR."

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**BEST BOILER FEEDERS IN THE WORLD.**

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# PATENT HOT POLISHED SHAFTING.

**Superior to any shafting in market for the following reasons, viz.:**

1st.—It is perfectly straight and round.

2d.—It can be rolled accurately to any desired gauge.

3d.—It has the beautiful blue finish of Russia Sheet Iron, rendering it less liable to rust or tarnish than shafting of the ordinary finish.

4th.—It will NOT SPRING or WARP IN KEY SEATING like most of the other manufactured shafting sold in the market, and as a consequence, is admirably adapted for LINE AND COUNTER SHAFTING.

5th.—The surface is composed of MAGNETIC OXIDE OF IRON, forming a superior journal or bearing surface.

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Sizes made from ¾ to 3½ inches, advancing by sixteenths.

Price lists, with references and other information furnished on application to

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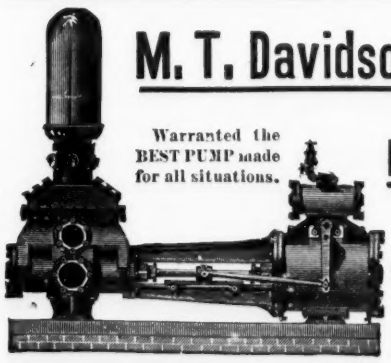

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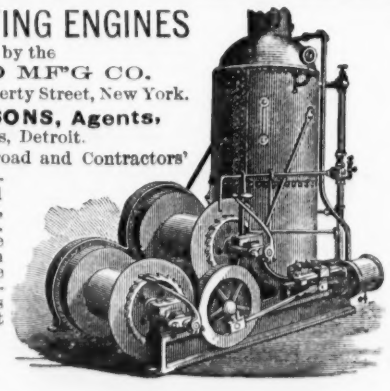

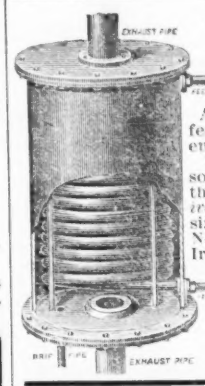


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A brass coil heater supplying feed water at 210° to 212° Fahrenheit by use of exhaust steam. Our prices are low and reasonable, and we aim to supply the *cheapest, best and most effective Heater in the market.* Fifteen sizes. No 1, 8-horse Heater, $17. No. 10, 100-horse Heater, $150. Iron, Brass and Copper Coils and Bends made to order. Circulars and price lists sent on application.

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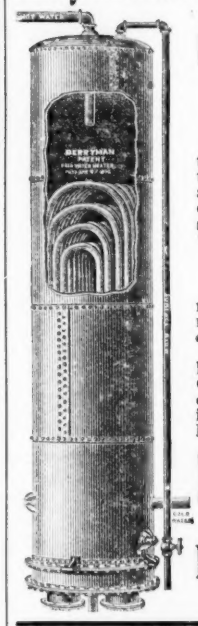


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Has seamless drawn brass tubes. The U shape of the tube prevents their being affected by expansion or contraction.

**This Heater has been in constant use Ten Years.**

None have ever required repairs. Gives the highest results attainable by the use of exhaust steam.

**IT IS ALSO THE ONLY HEATER APPLICABLE TO CONDENSING ENGINES,** increasing the vacuum and imparting a high degree of heat to the Feed Water.

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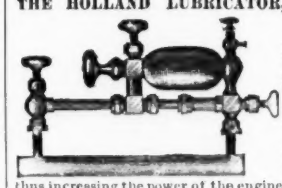
**THE HOLLAND LUBRICATOR, VISIBLE DROP,**



Is guaranteed to be 1. A perfect insurance against the cutting of Valve-seats, Cylinder and Governor Valves of the engine. 2. It will pay for itself in 6 months in saving of oil, coal, and packing. 3. It will insure more speed in the revolutions of the engine, say from 1 to 2 strokes per minute, thus increasing the power of the engine. Manufactured by HOLLAND & THOMPSON, 217 River St., Troy, N. Y.

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## Improved Adjustable Stock & Dies

**FOR PIPE AND BOLTS.**

Tapped to Standard Gauges. *Adjustable* to all variations in the size of fittings. Can be *resharpened without drawing the temper* by simply grinding them. Possessing practical advantages appreciated by all mechanics. Circulars sent free on application.

Manufactured by F. ARMSTRONG, Bridgeport, Conn.

# H.W.JOHNS' ASBESTOS

**ASBESTOS ROPE PACKING,**
**ASBESTOS WICK PACKING;**
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Made of strictly pure Asbestos.

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**ASBESTOS LIQUID PAINTS, ROOF PAINTS, ROOFING, STEAM PIPE AND BOILER COVERINGS, FIREPROOF COATINGS, CEMENTS, ETC.**

Descriptive price lists and samples free.

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# LE COUNT'S HEAVY STEEL DOG,

With Steel Screws. Lathe Made and Hardened.

This dog is very heavy, and is warranted not to break with any work

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Full set, 19 Dogs, $26.35

When ordering, state as above, whether a full set or a set of 7, 9 or 11 smallest of a. Users of these dogs prefer them to any other make.

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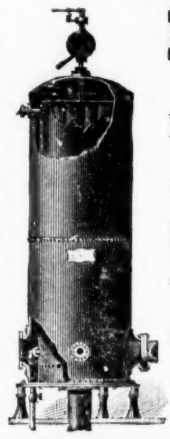

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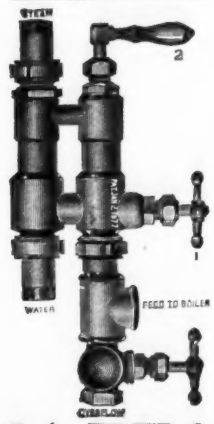


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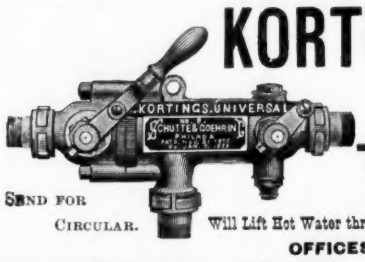


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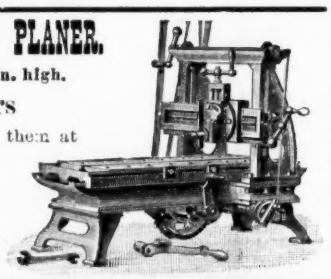

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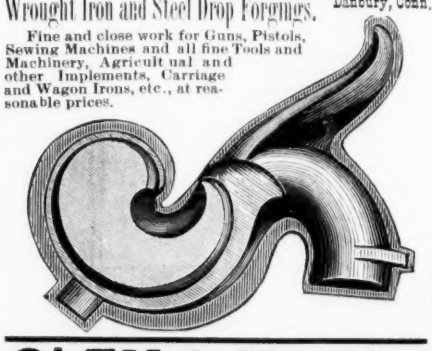

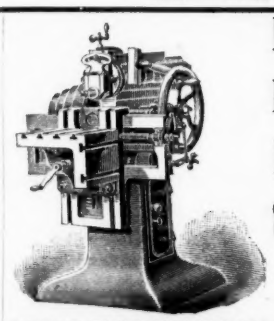

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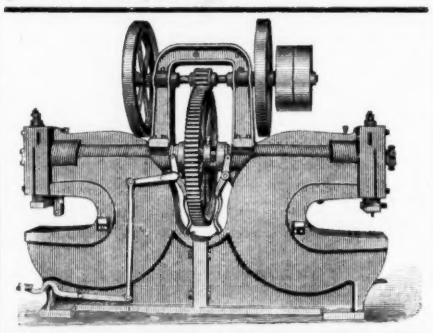

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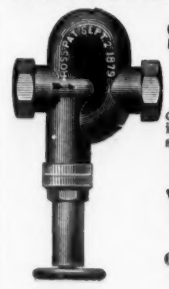

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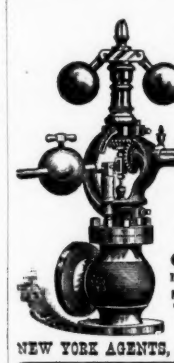

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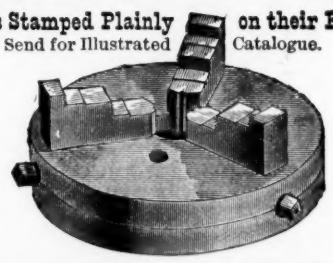

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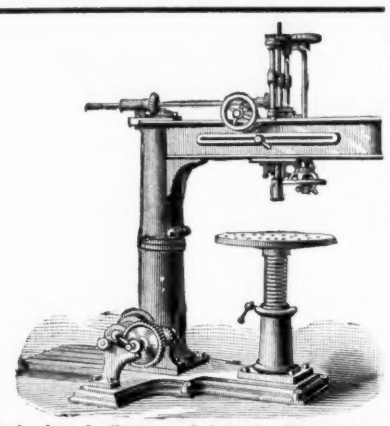

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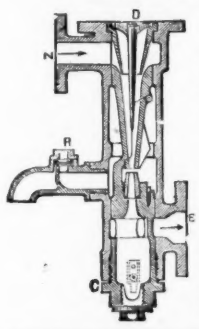

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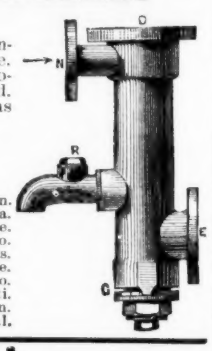

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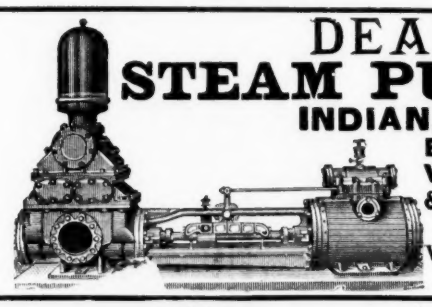

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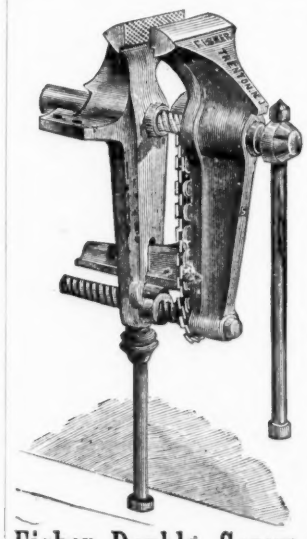

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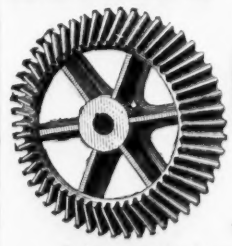

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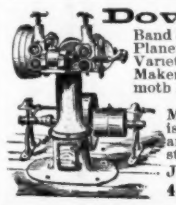

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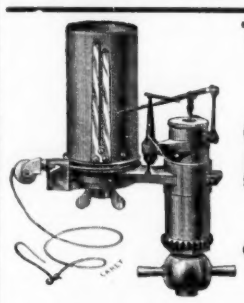

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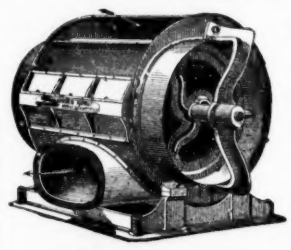

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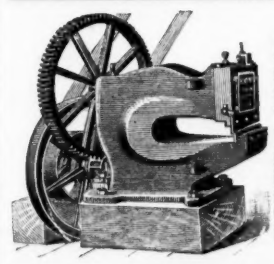

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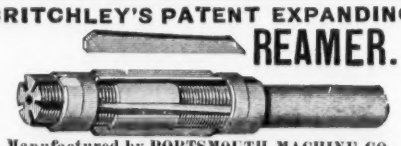

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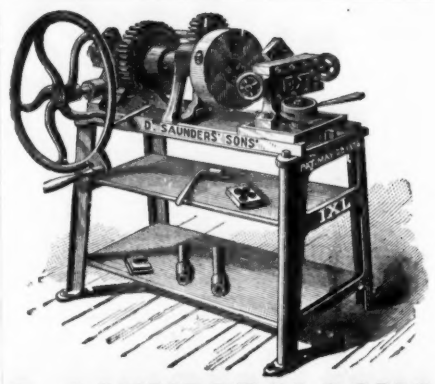

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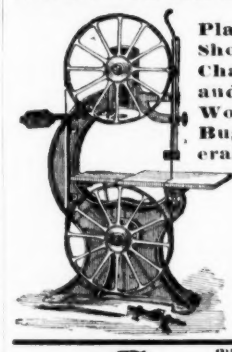

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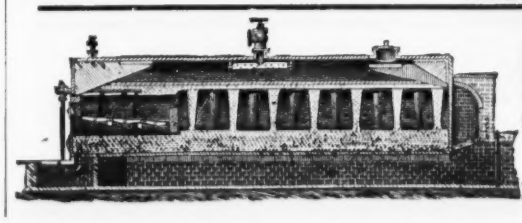

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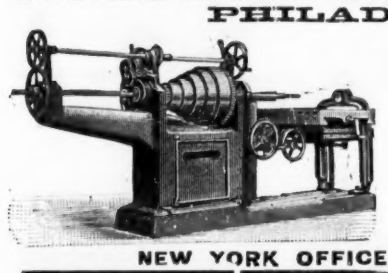

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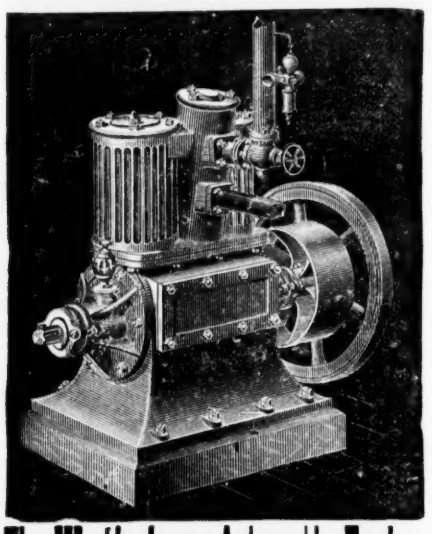

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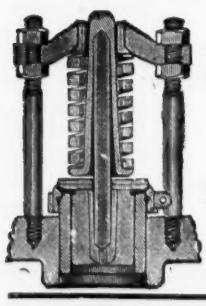

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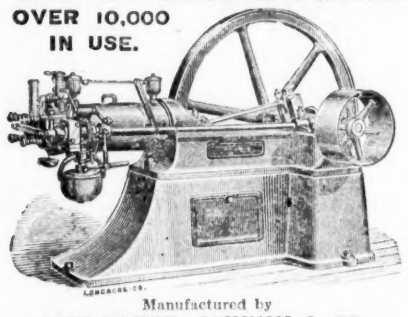

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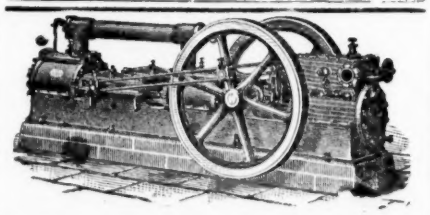

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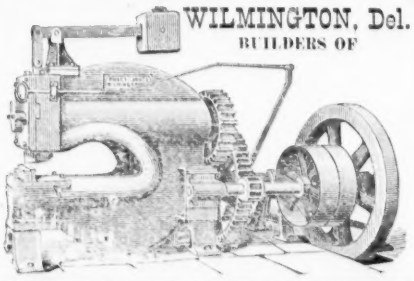

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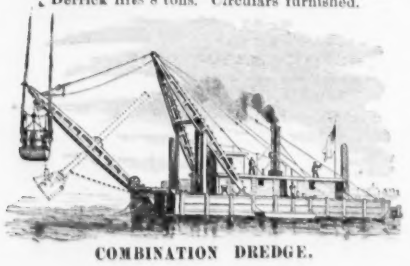

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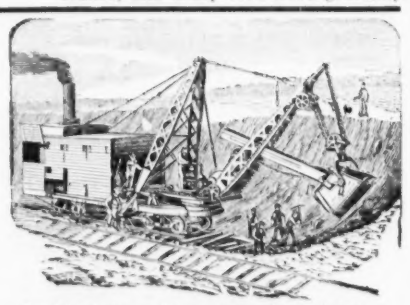

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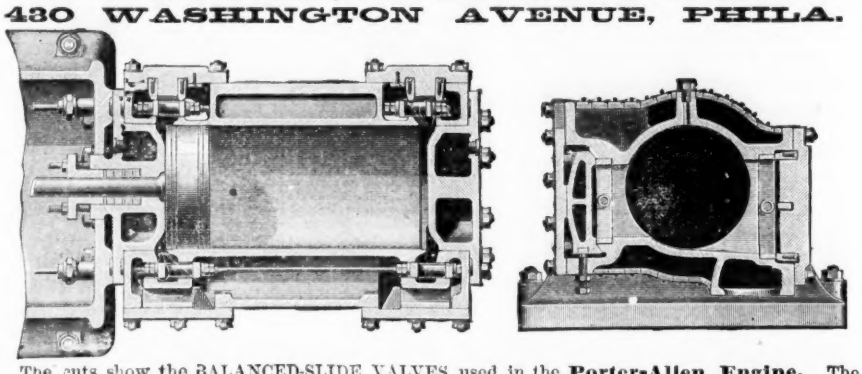

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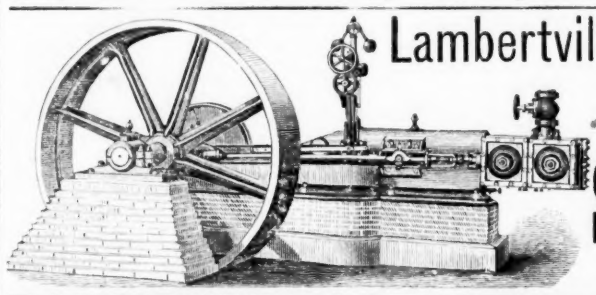

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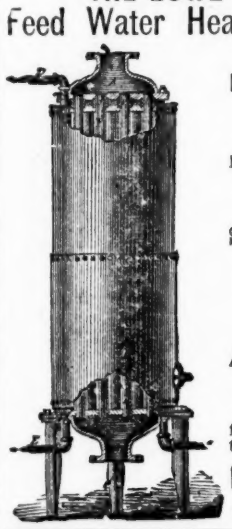

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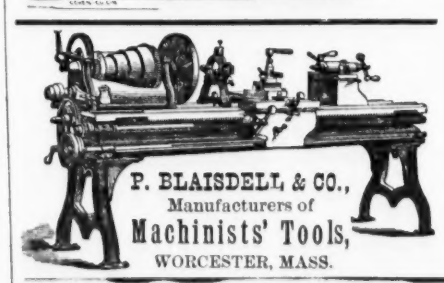

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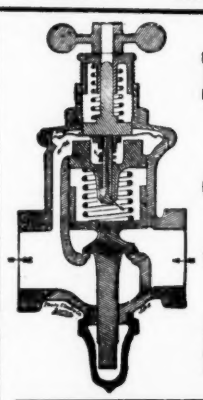

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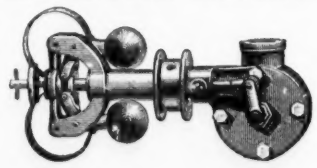

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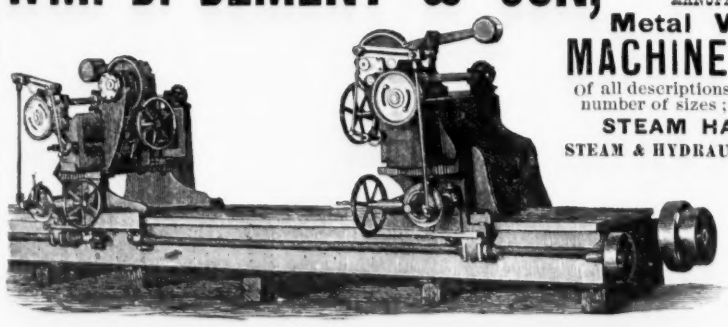

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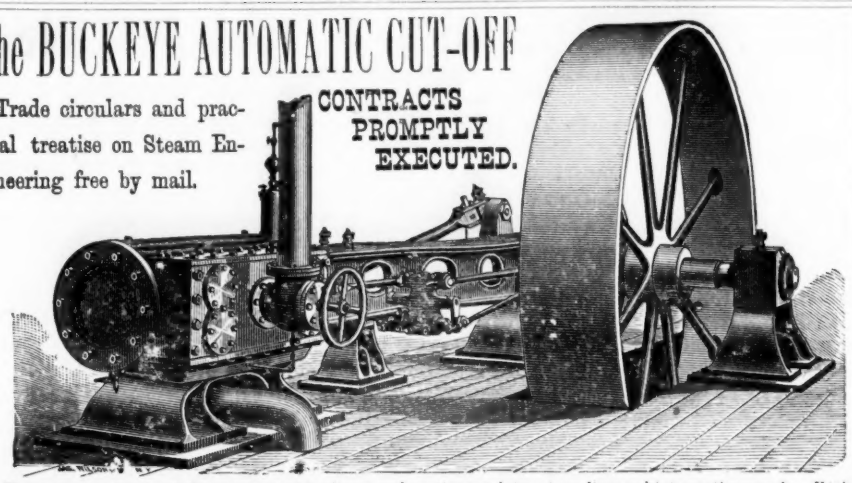

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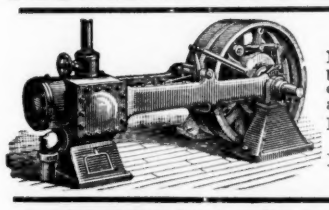

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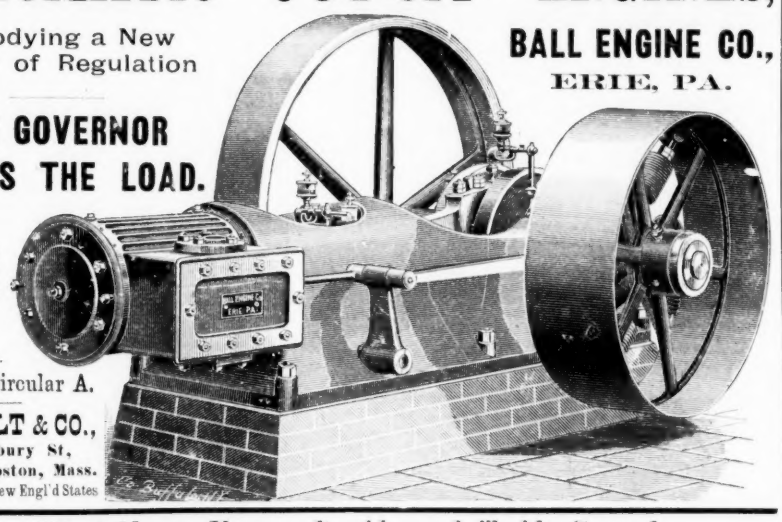

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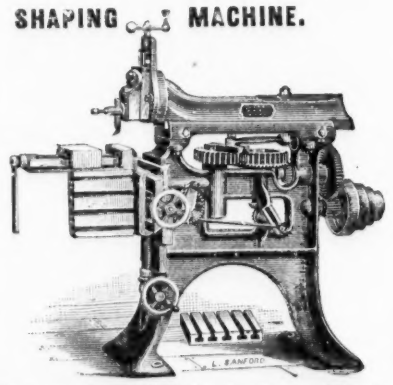

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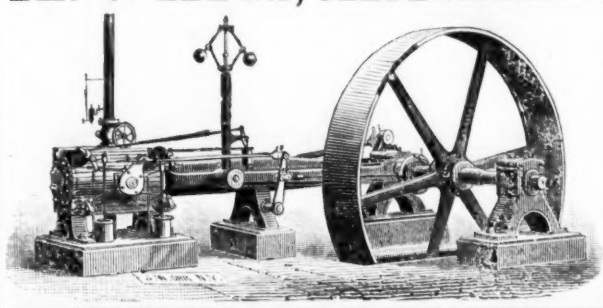

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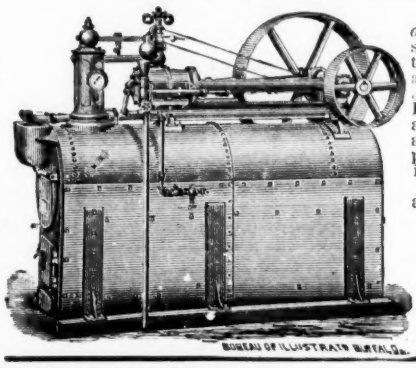

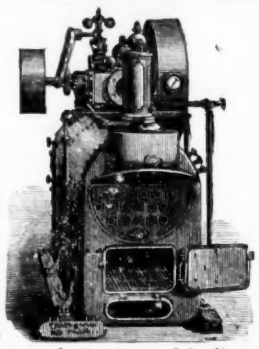

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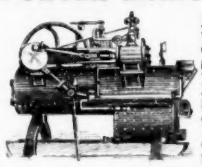

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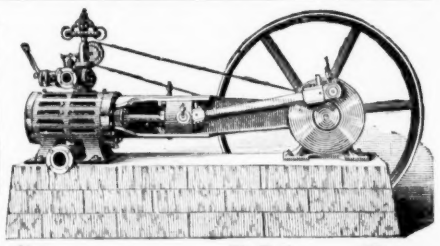

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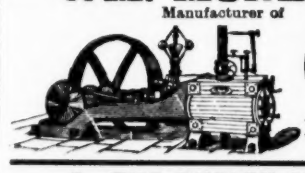

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**NEW.**

1 Engine Lathe, 10 in. x 3½ ft.
1 each, Engine Lathes, 11 in. x 4 and 5 ft.
1 each, " " 13 in. x 5, 6 and 8 ft.
1 Engine Lathe, 14 in. x 5, 6 and 8 ft.
1 " " 16 in. x 6 ft.
1 each, Engine Lathes, 16 in. x 6, 7, 8 and 10 ft.
1 Engine Lathe, 18 in. x 6, 8, 10 and 12 ft.
1 " " 20 in. x 8, 10, 12, 14 and 16 ft.
1 " " 22 in. x 8, 10, 12, 14 and 16 ft.
1 " " 24 in., any length of bed to 26 ft.
1 " " 26 in., " " 26 ft.
1 " " 28 in., " " 46 ft.
1 " " 28 in., " " 28 ft.
1 " " 30 in., " " 28 ft.
1 " " 36 in., " " 29 ft.
1 " " 42 in., " " 28 ft.
1 " " 48 in., " " 29 ft.
1 " " 15 in., x 4,6 and 8 ft. Rod feed only.
1 each, Turret Lathes, 13 and 14 in. x 14 in. x 6 ft.
1 Fox Turret Lathe, 16 in. x 6 ft.
1 Fox Lathe, 15 in. x 5 ft. Round Arbor.
1 each, Hand Lathes, 10, 12, 15 and 18 in. swing.
1 Iron Planer, 18 in. x 18 in. x 3 ft.
1 each, Iron Planers, 20 in. x 20 in. x 4 and 5 ft.
1 Iron Planer, 24 x 24 x 6 ft.
1 each, Iron Planers, 26 in. x 26 in. x 7 and 10 ft.
1 Iron Planer, 30 x 30 in. x 10 ft.
1 " " 36 in. x 36 in. x 10 ft.
1 each, 16, 20, 22, 23, 25, 28, 30, 34 and 38 in. Upright Drills.
1 each, Nos. 2, 3, 4 and 6 Spindle Gang Drills,
1 each, 8, 10, 12, 15, 18 and 24 in. Shapers.
1 each, 1, 2, 3 and 4 Milling Machines.
1 No. 2 Milling Machine. Lincoln Pattern.
1 New Pattern Milling Machine. Grant & Bogert.
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1 each, Nos. 3 and 7 Spindle Nut Tapper.
1 Boring and Turning Mill, each 50 and 72 in.
1 Gray's Screw Machine, to take all sizes to 1 in.
1 26 in. Gear Cutter.
1 Grant & Bogert Cutter Grinder.

**SECOND-HAND.**

1 Engine Lathe, 16 in. x 6 ft.
1 each, Engine Lathes, 18 in. x 6 and 8 ft.
1 Engine Lathe 18" x 8 feet.
1 Engine Lathe, 26 in. x 18 ft.
1 Planer, 24 x 24 x 5 and 6 ft.
1 " 36 x 36 x 10 ft.
1 " 20 x 20 and 4 ft.
1 " 18 x 18 and 3 ft.
1 10 in. Shaper.
1 2-Spindle Edging Machine
2 Lincoln Pattern No. 2 Millers.

**All Kinds Machinist's Tools and Supplies.**
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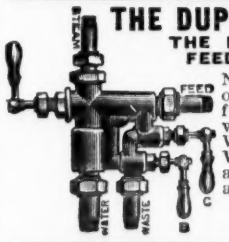
**THE BEST BOILER FEEDER KNOWN.**




Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

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We have the following second-hand Machinery for sale, viz:

One Planer, to plane 60 in. x 60 in. x 21 ft. long. Bement's make.

One Iron Planer, to plane 12 feet long, 36 in. x 32 in., in fair condition.

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One Iron Planer, to plane 8 ft. long, 30x30 in.

One Iron Planer, to plane 7 ft. long, 30x30 in.

Two Iron Planers, to plane 6 feet x28x28 inch.

Two Iron Planers, to plane 4 feet x20x20 inch.

One Iron Planer, to plane 8 feet x27x27 inch.

One 36 in. Car Wheel Borer, very good order.

One Slotting Machine, 12 in stroke, slots to the center of 46 in. Adjustable table and universal feed motion.

One Combined Power Punch and Shears, to punch ⅝ and ½, and shear ½ in. iron.

One Car Axle Lathe, Fitchburg Machine Co.

One 12 in. Shaper, Lowell Machine Shop.

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Two 4 in. Spindle Drills.

Send for List of New Machinery.

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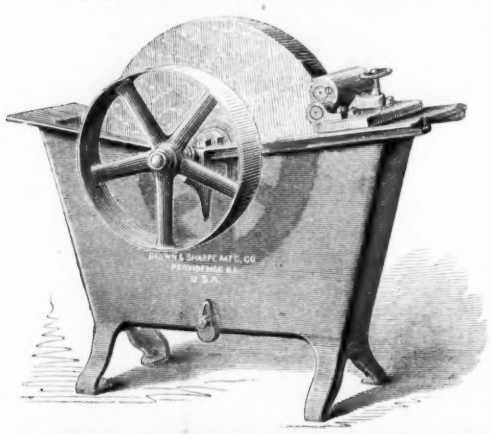
### IMPROVED GRINDSTONE TROUGH.



This cut represents a grindstone trough combining a number of very desirable qualities. In addition to the ordinary arrangement of trough, spindle, and pulley, it is provided with self-oiling boxes and an adjustable truing device which can be instantly applied to the face of the stone, working automatically, and without dust, keeping the face of stone always in good shape without interfering with its constant use.

DIRECTIONS.—The stone should revolve so as to have the device upon the face which moves upwards. The main stand or bottom piece of the device is securely clamped upon the trough close to the face of the stone, then by turning the hand wheel the threaded roll is brought into contact with the face of the stone and allowed to remain as long as is requisite to produce the desired result. The water is to be left in the trough as usual. When by long use the thread on the hardened roll becomes worn, it can be re-cut, which operation may be repeatedly performed.

Weight 600 pounds; with 40-inch stone, 1,000 pounds.

**PRICE, WITHOUT STONE, $70. PRICE, STONE INCLUDED, $85.**

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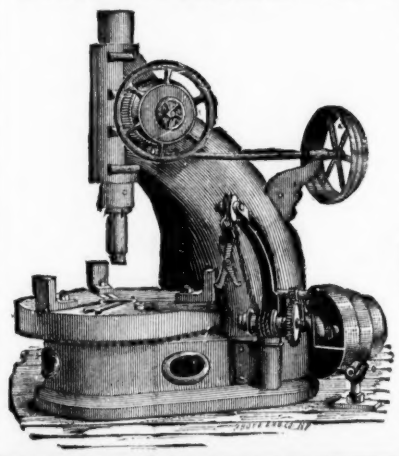

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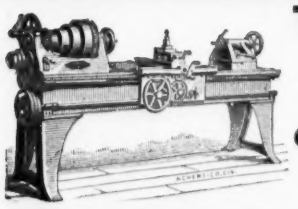

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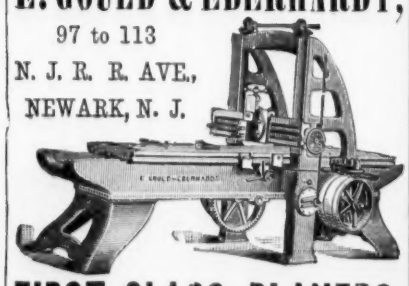

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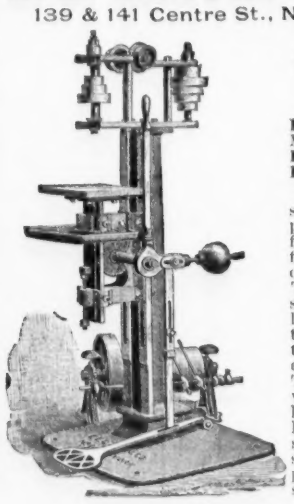

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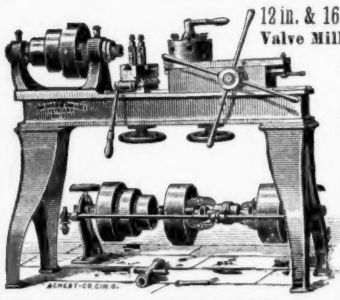

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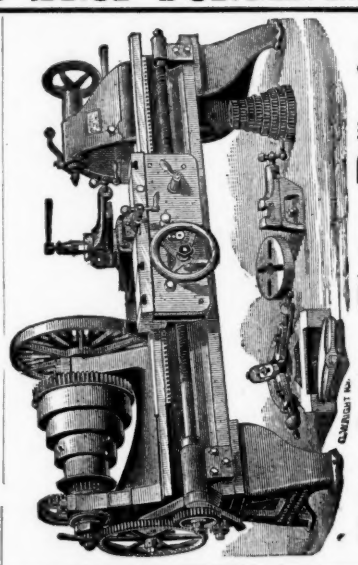

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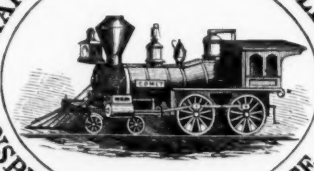

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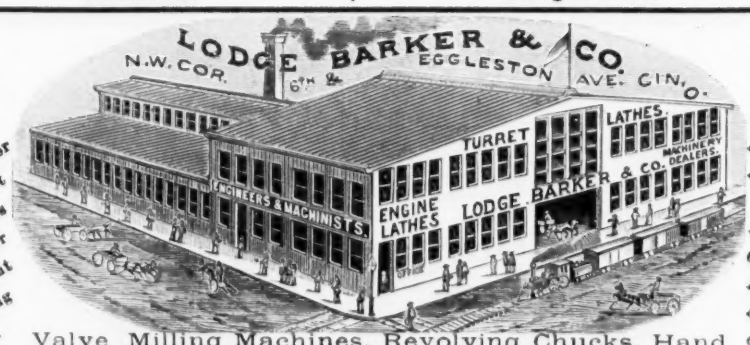
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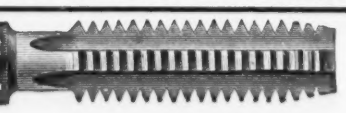

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